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The American Journal of Alternative Agriculture provides an international forum for original research articles on the biological, physical, social science and policy aspects of alternative agriculture. The journal particularly focuses on multidisciplinary studies and covers the character and potential of alternative, sustainable and organic farming systems.

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Variation in organic standards prior to the National Organic Program

T. Robert Fetter and Julie A. Caswell

Abstract. *Interest in establishing nationally uniform certification, labeling, and management standards for organic products grew out of concern that the existence of multiple standards led to consumer and supply chain confusion about, and lack of confidence in, these products. The National Organic Program Final Rule, issued in December 2000, is the result of this interest. We analyze the certification system that was in place prior to the new national rule to evaluate the extent of differences between certification standards and how the national rule is likely to impact the market for organic products. Our analysis suggests that most differences among US certification standards were minor. Also, the most important impacts of the national standard may be in facilitating trade in ingredients and products certified by different certifiers, increasing buyer confidence, and facilitating exports. However, the national rule may decrease the ability of organic certifiers and consumers to place differing emphasis on the multiple goals of organic production and may decrease the flexibility of organic standards to respond to changing market conditions, including new technologies.*

Key words: organic agriculture, organic certification standards, organic labeling, organic market

Introduction

The 1990 Organic Foods Production Act (OFPA) instructed the US Dept of Agriculture (USDA) to write a national standard for organic production. Proponents of the OFPA argued that in the growing market for organic foods, confusion reigned over exactly what 'organic' meant. They said a nationally uniform standard would improve welfare by eliminating confusion among consumers, reducing transaction costs for processors and handlers of organic foods, and providing other benefits. The National Organic Program (NOP) Final Rule, issued in December 2000, was the culmination of 10 years of often contentious work by the USDA with organic producers, certifiers, consumers, and other interested parties.

Here we analyze the certification system in place prior to the national rule, to evaluate the extent of differences between certification standards and how the national rule is likely to impact the market for organic products. Part I presents an overview of the organic products industry and the regulatory system prior to the national rule. Part II is a comparison of 18 organic certification programs in use in the late 1990s and three certification programs designed for national or international use. Part III presents an evaluation of how the national rule is likely to impact markets for organic products.

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I. Regulatory Background of the Organic Industry

Until the late 1980s, most organic food was sold close to the point of production and personal trust between consumers and producers functioned fairly well as a guarantee of organic quality (Hall, 1997). As organic foods traveled greater distances, consumer, producer and other groups offered organic certification as an independent, third-party (i.e., not by the buyer or seller) guarantee that only organic methods and materials were used on products labeled organic. By 1998 at least 55 organic certifiers operated in the US (OFRF, 1999). These certification organizations generally varied according to regions rather than products they certified.

Before 1990 there was little state regulation and no federal regulation of the term 'organic'. Labeling fraud was probably infrequent, but there were other negative consequences of the lack of standardization. Processors found it difficult to produce foods with ingredients certified by several different agencies because the processor's certifier sometimes refused to accept another agency's certification. Some producers were concerned about other organic producers receiving the same price premium while following less strict production standards. Some also worried that the appearance of loose regulation might harm consumer demand for their products and the ability to export. Attempts by the organic community to agree on minimum production standards and agency operating procedures were unsuccessful, and in the late 1980s some industry members lobbied Congress to pass a law requiring that all products labeled 'organic' be certified to meet federally sanctioned standards. The Organic Foods Production Act of 1990 (OFPA) was the result. The NOP Final Rule is the third complete draft published by the

Table 1. Key differences between decentralized system and National Organic Program.

Characteristic	Decentralized system	National Organic Program
Requirement for certification	Certification requirement varies by state	Certification is mandatory for producers wishing to use 'organic' label (if producer's volume of organic sales exceeds $5000)
Number of certifiers	Many	Many
Standard for production	Many (varies by certifier)	One standard, unless production contract specifies higher standard; state programs may use higher standards if approved by US Secreta of Agriculture
Oversight of certifiers	Optional accreditation	Mandatory accreditation
Authority to decertify operations	Certifier	Certifier (US Secretary of Agriculture can also initiate decertificatio
Authority to hear and decide certification appeals	Certifier	US Secretary of Agriculture or administrator of state program
Authority to revise standards	Certifier	US Secretary of Agriculture, advised by National Organic Standard Board
Authority to recognize other certifiers	Certifier	All US certifiers must recognize one another

USDA. The USDA received significant public comment about both previous drafts, especially the first Proposed Rule issued in December 1997.

Organic standards grew more similar in the time between the passage of OFPA and the adoption of the final rule in December 2000. In the early 1990s producers and certifiers cooperated to found the Organic Certifiers Council (OCC) of the Organic Trade Association (OTA). Another joint venture was the Organic Materials Review Institute (OMRI), which conducts research on the organic acceptability of materials used in production. These and other initiatives facilitated mutual recognition among organic certifiers and brought different certifiers' standards much closer to one another. In addition, efforts to write an industry consensus standard continued. The American Organic Standards (AOS), completed under the auspices of OTA in October 1999, are the latest such standards.

The regulatory situation during the 1990s

During the 1990s, government regulation of organic certification and labeling consisted mainly of a patchwork of state laws. The OFPA outlined some requirements for organic production but those requirements were essentially not enforced. By the late 1990s, 17 states required certification for products to be labeled organic (OTA, 1996). Thirteen additional states did not require third-party certification and inspection but did have some regulation, ranging from a single sentence to very complete production standards. Of these 13, at least two required registration with the state department of agriculture as well as adherence to specific production standards. Twenty states did not regulate the term 'organic' on food products.

Because of the patchwork nature of state laws, third-party certification was the most important guarantee of organic production in the market. Even though only 17 states required certification to use the term 'organic', producers could choose to be certified for other reasons. For instance, processors and farmers who sold products to regional or national markets might have found it cost-effective to follow the labeling laws of the strictest state in which they sold, rather than selling certifi product in one state and uncertified product in another.

A study of producers in California (Tourte and Klonsky, 199 provides some evidence of the proportion of organic farms th were certified. From 1992 to 1995, certified organic far represented less than half of all registered organic farms California but accounted for about 80% of organic hectarage a about 90% of sales of organic products. These figures probab exceed the national average: since all California producers usi 'organic' had to register with the state and submit certa documents, the additional cost of certification for the (considering financial as well as management and recor keeping costs) was likely to be less than in other stat However, it is likely that in the US overall, at least the major of food and fiber sold as 'organic' was certified, and the figu may have been as high as 75–80%.

A distinguishing feature of organic certification is that concerns primarily the complex processes of production, rath than the product itself. The diversity of production process along with the detailed and complex standards for organ production, meant that organic certifiers rarely enforced th written standards exactly and without exceptions. A survey of organic certifiers suggests that many organic produce processors, and handlers are 'identified as having so deficiency, yet retain their certification status each year . because that is the nature of organic agriculture, a constan improving system and standard' (OCC, 1998). In the 199 standards became more harmonized and generally stricter Gillan, New England Small Farms Institute, Belchertow Massachusetts, personal communication, April 199 However, some certifiers may not have been enforcing th strict standards.

Another important aspect of certifier behavior is that orga certifiers may believe that the reputation of the entire indus depends on how consumers perceive their integrity as a gro For instance, a highly publicized fraud case in 1994–1997 w generally seen as damaging to the organic industry as a whc not just to the certifier involved (Kindberg, 1997; Mergentir 1997). As a result, certifiers could be reluctant to publicly rep

wrongdoing by another certifier, if they believe that doing so might affect the overall reputation of organic products (IOIA, 1998). Accreditation, the process of making sure that certifiers enforce their standards and run effective programs, provides an additional check on how certifiers operate. In 2000, seven US organic certifiers were accredited by one or more accreditation agencies (AMS, 2000a; IFOAM, 2000). Prior to implementation of the national rule, the main benefit of accreditation was access to export markets.

Structural differences between the old and new systems of regulation

The key structural differences between the old and new regulation systems are shown in Table 1. The old system featured many different certifiers, each with its own standards and program management guidelines. Accreditation of certifiers was optional. Individual certifiers had complete authority over decisions of certification and decertification, recognition of other certifiers, and revisions of standards.

The regulatory system under the National Organic Program (NOP), like the old system, is carried out by many different certification organizations. However, most certifiers use the national standard for organic production, with two exceptions. Certification programs operated by state Departments of Agriculture have the right to enforce standards higher than the federal standard. Also, both private and state agencies may enforce higher standards if contract specifications require production to higher organic standards (e.g., for export). USDA or its agent accredits all certifiers. Certifiers will likely be permitted to certify 'on conditions'; that is, to certify operators that do not fully comply with the written standards if they can show reasonable cause. The ultimate authority for revising the federal standards lies with USDA. Individual certifiers have the authority to certify applicants and deny certification in the event of a violation, but the Secretary of Agriculture (or the state organic program administrator) will hear any appeals from operations denied certification. All US certifiers are required to recognize each other's certification.

II. Comparison of Organic Certification Programs

The central difference between the old and new regulatory systems is a move from many standards to essentially one standard for organic production and labeling. To assess the likely market impacts of this change, we first present a detailed description of the standards, certification program management, and labeling guidelines in place in the late 1990s. We compare 18 state and private certification programs and analyze differences in their standards and programs. We also present a parallel comparison of three certification programs designed for national or international use: the 1998 IFOAM Basic Standards, the 1999 American Organic Standards, and the USDA's National Organic Program Final Rule (AMS, 2000b). We did not incorporate material from the Program Manual, a document that is currently being written and which will be finished by the time the Final Rule is fully implemented (currently scheduled to be October 2002). The Program Manual will serve as guidance for certifiers regarding implementation of the NOP standards (AMS 2000b, p. 38).

We compared several directories of organic certifiers and identified over 50 certifiers operating in the US in 1998. Of these, we chose 18 for the comparison of standards (Table 2). Because of the complexity and detail of organic certification standards, using a sample was necessary in order to set up a comprehensive comparison. We chose our sample to represent the diversity of certification programs in terms of geographic location, extent of geographic coverage, and for-profit or non-profit status. In addition, we chose our sample to include the majority of certified organic sales in the late 1990s. Included in the sample are six programs operated by State Departments of Agriculture, six large, private programs, and six smaller private programs. In all, these 18 programs certified over 3000 farms, according to the Organic Farming Research Foundation (OFRF, 1998), of the approximately 5000 certified farms in the US. We called the selected programs and asked for their current (1998) certification standards and administrative procedures. Nearly all certifiers were called between April and June 1998.

Nine of the 12 private programs are not-for-profit operations. Seven of the 12 private programs had some organizational link to a group that advocates for, or educates people about, organic foods. Eight certifiers, including all six of the large private programs, certify operations outside the US. All six state-run programs, and two of the smaller private programs, certify operations in only one state. Accreditation was fairly common among the larger certifiers; one or more third parties accredited five of the six largest programs. Only one of the six small certifiers was accredited. Although none of the state-run certifiers were accredited by a third party, for each there was some degree of state government oversight of their operations. While all certifiers had procedures for recognizing other programs' certification, only some had standing agreements with other certifiers by which mutual recognition was more automatic.

Organization of the comparison

In designing our analysis, we found no prior frameworks for comprehensively comparing US organic programs. We did find two previous international comparisons (Lavender, 1998; Riddle and Ford, 1997) that provided some guidance. In addition, we drew ideas from the issues cited by producers, consumers, and certifiers who commented on the two drafts of the USDA NOP Rule. We also asked members of the organic industry and organic certification programs about major differences they perceived. In the end, our list of issues to compare came primarily from extensive work with the standards themselves.

We included over 200 specific criteria in the final comparison (Table 3). Due to space constraints we are unable to present the complete results here; interested readers can find the full comparison at <http://www.umass.edu/resec/organicstandards>.

Table 2. Organic certification organizations included in comparison.

Acronym	Full name	1998 number farms[1]	1998 number of processors and handlers[2]	Founded	Area covered	Type[2]	Accreditation[3]	Recognition
State-Run Certification Programs								
CDA	Colorado Dept of Agriculture	150	0	1989	CO	S	None	None
IDA	Idaho Department of Agriculture	140	7	1990	ID	S	None	OTCO, WSDA
KDA	Kentucky Department of Agriculture	72	1	1990	KY	S	None	None
MDA	Maryland Dept of Agriculture	57	1	1991	MD	S	None	Other states[4]
TDA	Texas Dept of Agriculture/Texas Certified Organic Program	150	86[5]	1988	TX	S	None	None
WSDA	Washington Dept. of Agriculture/Organic Food Program	370	166	1988	WA	S	USDA	OTCO, CCOF, others[6]
Large, Private Certification Programs								
CCOF	California Certified Organic Farmers	750	90	1973	CA, International[7]	NP	IFOAM, USDA	OTCO, FVO, WSDA
FVO	Farm Verified Organic	150	50	1979	International	FP	IFOAM, USDA	CCOF
OCIA	Organic Crop Improvement Association International	2200[8]	400[9]	1985	International	NP	IFOAM,[9] USDA	FVO
OGBA	Organic Growers and Buyers Association	450	75	1977	International	NP	IFOAM, USDA	FVO, CCOF, OTCO
OTCO	Oregon Tilth Certified Organic	283	NA[10]	1981	OR, International	NP	IFOAM, USDA	CCOF, OCIA, QAI
QAI	Quality Assurance International	312	NA[10]	1989	International	FP	USDA	None
Small, Private Certification Programs								
CFSA	Carolina Farm Stewardship Association	65	0	1987	NC, SC	NP	None	None
FOG	Florida Certified Organic Growers and Consumers	72	25	1989	FL, Costa Rica, Latin Amer.	NP	USDA	None
NOFA-MA	Northeast Organic Farming Association – MA	63	0	1986	MA	NP	None	Northeast[11]
NOFA-NY	Northeast Organic Farming Association – NY	180	10	1984	NY	NP	None	Northeast[11]
OEFFA	Ohio Ecological Food and Farm Association	200	4	1983	IN, KY, MI, OH, PA, WV	NP	None	None
SCS	Scientific Certification Systems	8	0	1989	International	FP	None	None

[1] Data are from personal interviews with certifiers. Except where noted, all numbers indicate certified operators within the United States.
[2] Type of certifier (NP, non-profit; FP, for profit; S, state agency).
[3] 'USDA' accreditation was offered beginning in 1999 to help certifiers interested in the European export market. It is not the accreditation that will be required under OFPA; no accreditation under OFPA had happened as of the late 1990s.
[4] Certifier extended recognition to all other state-run organic programs.
[5] Does not include 805 certified retail operations.
[6] Formally recognized about 50–60 organic programs, automatically permitting products certified by them to be used as inputs for WSDA-certified producers.
[7] Certified an operation outside California if the parent company was located in California.
[8] Number of farms and processor/handlers for US and Canada.
[9] IFOAM accreditation pending.
[10] Information unavailable or declined to provide information.
[11] The 'Northeast' recognition agreement linked programs in Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, and Vermont. It was suspended in the late 1990s.

Table 3. Criteria for comparison of organic certification programs.

Principles and general goals of organic production
Environmental and labor principles
- Improve soil, prevent soil erosion
- Minimize environmental pollution from agriculture
- Protect biodiversity or wildlife habitat around farm
- Compare the farm to an ecosystem
- Provide safe environment for farm laborers

Materials principles
- Avoid using prohibited materials
- Emphasis is on avoiding prohibited materials and practices, rather than on improving soil or other goals
- Reduce off-farm inputs or buy local inputs

Food quality principles
- Provide high-quality food
- Provide safe food
- Certifier acknowledges that organic food isn't residue-free
- Provide nutritious food
- Discourage excessive processing/process minimally

Economic system principles
- Promote regionally organized agricultural or economic system (sell product locally)
- Create 'economically sustainable' agriculture (e.g., 'where producers have an adequate return')

Regulation of materials
Approaches to regulation
- Certifier has a Materials List for generic materials
- Restricts individual materials beyond minimum legal requirements
- Certifier uses the Organic Materials Review Institute (OMRI) list as a source to formulate its materials list
- Certifier emphasizes avoiding prohibited practices/materials, not soil building or other 'positive' goals
- Has categorical restrictions on all 'regulated' materials:
  - Operator must reduce use over time, or use is discouraged
  - Operator must get permission before use
  - Operator must submit separate list to certifier of all regulated/restricted materials used

Materials for crop production
- Raw manure: required interval after use before crop can be harvested
- Fungicide-treated seed is prohibited or regulated
- Non-certified annual seedlings prohibited
- Strychnine prohibited or regulated
- Nicotine prohibited
- Piperonyl butoxide prohibited
- Herbicidal micronutrient doses prohibited
- Sodium (Chilean) nitrate prohibited
- Glossy paper/colored inks prohibited
- Use of GEO/GMO materials prohibited
- Use of GEO/GMO derivatives prohibited
- Biosolids (sewage sludge) prohibited
- Irradiation prohibited

Organic crop management
Organic plan, transition time, and parallel production
- Organic plan required; plan or update must be submitted annually; on-site inspection at least annually
- Crop rotation required for annual plants
- 36-month transition between application of prohibited material and harvest of certified organic crop
- 'Transitional organic' product labeling is permitted
- Soil nutrient test is required for certification
- Soil residue test is required for certification
- 'Parallel production' is allowed, if additional record keeping/organizational requirements are met
  - But whole-farm conversion is encouraged or required
  - Must report practices or materials used on non-certified land
  - Must use IPM/least-toxic methods on non-certified fields
- Rotating fields in and out of organic production (even with full transition time) is prohibited
- When irrigating, operator must practice water conservation

Table 3. *Continued*

Unintentional contamination
- Buffer zone requirements (space separation, physical barriers, runoff diversion)
- Operator must test irrigation water regularly for contamination by organically prohibited materials
- Regular residue tests required for soil
- Regular residue tests required for crops
- Allowable residue level for residues in produce
- Crop with residues over allowed limit can never be labeled 'certified organic', regardless of reason
- Consequences of drift of prohibited materials on to certified crops or land, when drift is not due to fault of certified operator
  - Crop cannot be labeled 'organic', regardless of amount of drift
  - Affected land is automatically decertified, regardless of the amount of drift

Organic livestock production

Sourcing and conversion
- Sourcing animals from same farm preferred
- Slaughter animals:
  - Animals not born into certified organic operation may be converted to certified status
  - Time required under organic feed requirements
  - Time required under organic healthcare requirements
- Dairy animals:
  - Conversion time under organic feed requirements (including non-medicated feed)
  - Conversion time under organic healthcare requirements
  - More lenient conversion period for new herds
  - If replacing many animals at once (after catastrophic loss), animals can be certified in less time
    - But a limited amount of total production can be from these animals
- Broilers and other fowl (certified meat):
  - Day-old chicks can be from any source
  - Maximum age for conversion is 1 day old
- Concepts embedded in definition or list in preamble
  - Day-old chicks can be from any source
  - Maximum age for conversion is 1 day old
    - If not, then time required under organic management for eggs to be certifiable
- Animals for non-edible livestock products:
  - Conversion time under organic feed requirements
  - Conversion time under organic healthcare requirements

Housing and husbandry
- Slaughter and dairy mammals:
  - Edible bedding must be certified organic
  - Access to indoor or outdoor exercise areas is required (season/weather permitting)
  - Daily access to outdoors is required (weather and stage of production permitting)
  - Standards specify access to outdoor areas with green pasture
  - Routine or extended indoor confinement prohibited
  - When animal is indoors, free access to a non-cement floor is required
- Poultry for meat and eggs:
  - Edible bedding must be certified organic
  - Regular access to outdoor areas is required (weather and stage of production permitting)
  - Standards specify access to outdoor areas with green pasture
  - Housing in indoor fixed cages is prohibited
  - Lifetime indoor housing/confinement explicitly prohibited
  - Quantitative requirement of floor space per bird

Feed requirements
- Ideally, feed should come from on-farm
- Percent certified organic feed required (all animals)
- Limited proportion of total feed can be from additives, supplements, or concentrates
- 'Hot' dairy ration prohibited, or roughage/pasture must be offered as free choice
- Roughage (fresh plants, hay, etc.) must be offered to poultry
- Emergency feed provisions mentioned in standards
  - Producer's organic plan must include provisions for emergency shortage of certified organic feed
  - Absolute time limit stated for emergency feed allowances
  - Labeling restrictions on livestock products, if emergency feeding is required

Table 3. *Continued*

Healthcare requirements
- Preventative care emphasized as first defense
- Withholding treatment from sick animal is grounds for decertification
- Mandatory withdrawal period following approved internal use of synthetic antibiotics:
  - In slaughter mammals
  - In dairy mammals (for existing organic herd)
- Mandatory withdrawal period following approved internal use of synthetic parasiticides (dewormers):
  - In slaughter mammals
  - In dairy mammals (for existing organic herd)
- Subtherapeutic use of antibiotics is prohibited

Enforcement procedures
- Organic plan emphasized as enforcement tool
- Audit trail emphasized as enforcement tool
- Medical records for individual animals (or flocks, for fowl) must be traceable through life cycle
  - Animals must be individually identified on body by physical marker or tag (except fowl)
- Record keeping system must be adequate to ensure products of treated animals are not labeled organic
  - Animals treated with prohibited materials must be identified on body of animal (with tag, etc.) to ensure no confusion (except fowl)
- Certifier offers conversion program for producers interested in conversion
- Certifier offers transitional certification for livestock products

Organic processing and handling

Product guidelines by labeling category
- 'Organic' on principal display panel (PDP) requires 95–100% organic ingredients
  - Requires a different percentage
- 'Made with organic' (MWO) on PDP requires 50–95% organic ingredients
  - Requires 70–95% organic ingredients
- Products with some organic ingredients, but not enough to make the 'MWO' cutoff, can say 'contains organic [ingredients]' on information panel
  - Organic ingredients cannot be identified if entire product does not meet criteria for 'organic' label
- Certification of processing is required for 'organic [product]' and 'MWO [ingredients]' label claims
- Certification of processing is required even if labeling only identifies organic ingredients on side panel

Product composition
- For 'organic' and 'MWO' products:
  - Non-agricultural ingredients should be minimized
  - Certifier encourages using 100% organic ingredients, or requires preferential use of organic ingredients
  - Genetically engineered ingredients are prohibited
  - Irradiated ingredients are prohibited
  - Nutritional quality should be preserved in processing
    - This is emphasized in processing section, not just in principles of organic production
- Certifier allows an expanded set of non-agricultural ingredients in 'MWO' products
- Certifier allows any ingredient to be used in 'COI' products that are certified organically processed
- Processors making only 'COI' products are exempted from some non-composition requirements

Facility management
- Organic plan is required
- 'Parallel production' is allowed, if additional record keeping/organizational requirements are met
- Procedures to ensure organic integrity
  - HACCP or similar system involving critical control points
  - ISO 9000 series certification
- Extra withdrawal time required after fumigation with a prohibited material
- Regular or required residue testing of products
- Certifier can test for residues if reason for suspicion
- 'Ecologically sound' waste management plan
- Producer must minimize packaging

Handling regulations
- Certifier has detailed description of requirements for non-processor handlers
- Handlers dealing in only MWO or COI products are subject to less restrictive standards
- Handlers are subject to less restrictive standards or a less thorough certification and inspection process, if organic sales are below a specified level
- With each transaction in supply chain, both buyer and seller (if certified) must record transaction, date, and volume exchanged

Table 3. *Continued*

All processors and handlers must maintain audit trail sufficient to track raw materials from supplier to retail
On-farm processors must meet all processing standards
Organic labeling guidelines
Processed and unprocessed products labeled 'organic'
Certifier must pre-approve entire label
Label on retail item must identify certifier of the final handler or distributor of product
Certifier contact information is required on retail item
In multi-ingredient products, listing same ingredient from organic and non-organic sources is prohibited
In multi-ingredient products, listing an ingredient as 'organic when available' is prohibited
All products labeled 'organic'
'Transitional' product labeling
Transitional product certifiable
Transitional product can use same logo as certified organic
Label, seal, or statement contains the word 'organic'
Labeling through distribution chain:
'Organic' required on invoice
'Organic' required on non-retail container (box, bin, case, and/or pallet)
Certifier ID required on invoice
Certifier ID required on non-retail container (box, bin, case, and/or pallet)
Program provides another certification, in addition to 'organic' or 'transitional'
Seal is a registered trademark
Statements on packaged multi-ingredient foods
For products labeled 'organic' on PDP:
Certifier name may appear on PDP
Certifier logo may appear on PDP
Certifier name may appear on label
Certifier logo may appear on label
'Organic' must be smaller than product ID
Individual identification of organic ingredients on information panel
Statement of percent organic ingredients
For products labeled 'Made With Organic ingredients' on PDP:
Certifier name may appear on PDP
Certifier logo may appear on PDP
Certifier name may appear on label
Certifier logo may appear on label
On PDP, 'organic' must be smaller than product name
Individual identification of organic ingredients on information panel
Statement of percent organic ingredients
For products labeled 'Containing Organic Ingredients' on side panel:
'Organic' may not appear on label at all
Certifier name may appear on PDP
Certifier logo may appear on PDP
Certifier name may appear on label
Certifier logo may appear on label
Individual identification of organic ingredients on information panel
Statement of percent organic ingredients
Certification program management
General points
Confidentiality policy prohibits undue disclosure by inspectors and decision makers
Written conflict of interest policy prohibits financial interactions between applicants and inspectors/ decision makers, at time of application
And also 1 year before application
And also 1 year after application
Annual renewal of certification
Annual inspection of operation
Certifier performs unannounced second inspection on all first-time applicants
Certifier performs unannounced inspections on a random set of recertifying operators
Certifier reserves the right to make unannounced inspections at any time

Table 3. *Continued*

Certifier will investigate reasonable reports of violations
Certified operator can appeal decertification decision
Organizational structure
Program is run by non-profit organization
Program is run by for-profit organization
Program is self-sufficient in funding
Certifier employs permanent staff
Private programs: program is linked to an advocacy or education organization
Board of Directors of this organization has final decision in writing standards
Board of Directors of this organization has final authority for de/certification decisions
State programs: program has advisory board
Advisory board is mandated by statute
Board has input in standards decisions
Board has final decisions for standards
Board has input in de/certification decisions
Board has final decision for de/certification
Interactions with other certifiers and national bodies
Certifier communicates with other certifiers regarding standards or consistency
Standards state intent to compare with other standards or achieve consistency
Certifier is in the Organic Certifiers Council of the Organic Trade Association (OCC)
Certifier is in National Association of State Organic Programs (NASOP)
Certifier has standing recognition agreements, verbal or written
Certifier offers document review process for recognition of other organic certifications
Certifier is accredited by IFOAM
Certifier is licensed, authorized, or approved in some way be state(s) in which it operates
Basis for certification fees
Producers: Basis for fee
By sales volume
By physical size of operation
Flat fee for all producers
By another criterion
Fee pays for one or more inspections
Fee pays for one or more residue tests
Processors: Basis for fee
By sales volume
Flat fee for all processors
By another criterion
Fee pays for one or more inspections
Fee pays for one or more residue tests
Handlers: Basis for fee
By sales volume
Flat fee for all handlers
By another criterion
Fee pays for one or more inspections
Fee pays for one or more residue tests

COI, contains organic [ingredients]; GEO/GMO, genetically engineered/genetically modified organisms; HACCP, Hazard Analysis Critical Control Point; IPM integrated pest management.

The comparison is organized into seven sections:

1. Principles and general goals of organic production
2. Regulation of materials
3. Organic crop management
4. Organic livestock production
5. Organic processing and handling
6. Organic labeling guidelines
7. Certification program management

Because of the complexity of the task, and because certification decisions are often made based on operating procedures that are not fully explained in written standards, we verified the accuracy of our comparison with each certifier involved. We circulated a preliminary copy of the comparison to the 18 programs and asked program personnel to correct any misinterpretations. In our follow-up calls, we spoke extensively with representatives from every program.

Results

Principles and general goals of organic production. For all the certifiers in our comparison, the primary tool of organic certification was the organic management plan. The organic plan generally includes aspects of design and record keeping for the operation. For a farm, design components might include: (1) the history of the land; (2) maps indicating surrounding land uses, prevailing wind direction, soil types, water sources, and topographical features; (3) a farm equipment inventory; (4) plans for cropping practices; and (5) anticipated improvements. Record-keeping criteria for a farm might include: (1) soil, water, and crop tests; (2) records of management practices and materials used; and (3) documentation of yields. Similarly, an organic plan for a processing or handling operation would entail aspects of facility design, the management system, and record keeping. The organic plan is a key tool of certification because it allows producers and certifiers to communicate intended practices and still be flexible about those actually used.

Many of the organic standards include a list of the principles or purposes of organic production. Almost all programs (16 of 18) included some expression of environmental goals in their definition of organic production, such as improving soil quality or minimizing environmental pollution from agriculture. Twelve programs also stressed the importance of providing nutritious or high-quality food. These were the two most common goals but we identified many more areas where one or more certifiers set out additional goals of organic production. Six programs also stated or implied that organic production should aim to maintain the integrity of food during processing or supply foods with minimal processing. Eight programs said that organic systems should provide a safe and healthful environment for farm workers and other laborers. Three programs said that an important goal of organic production is to promote a regionally organized agricultural system by encouraging local sales.

We draw two main conclusions. First, it is clear that many certifiers believe organic production involves more than production practices. Secondly, there are sometimes disparities between the stated goals and the business practices of certification programs. For instance, one of the three certifiers that expressed the goal of promoting a regionally organized agricultural system certified many large, nationally marketed brands of processed and unprocessed organic foods.

Like the majority of programs, the USDA's National Organic Program includes a commitment to improving soil quality and implies that organic production minimizes environmental pollution from agriculture. The NOP also states that organic producers should protect biodiversity on the farm and its surroundings. Overall, the NOP is less ambitious than some programs in stating the goals of organic agriculture but is roughly consistent with many programs in this comparison.

Regulation of materials. Although organic management is usually defined as a system that enhances soil health, a key component of organic production is the non-use of certain materials. All the standards we reviewed included a Materials List that showed the materials that were allowed and prohibited in organic production. There were fundamental similarities in the way certifiers constructed their Materials Lists: programs us similar criteria and frequently made identical decisions abo organic acceptability. However, there were some disagreeme about the acceptable use of specific materials. There were al some differences in the way programs restricted the use certain materials. The main criterion for the organic acce ability of materials is that natural materials are allowed a synthetic materials are prohibited. However, there were exce tions on both sides. Certifiers also judged materials by th environmental impact, the rate of decomposition in the soil, t source of the material, the possibility that it was contaminat (for instance, mined minerals that may contain harm impurities), and the availability of alternative materials practices to accomplish the same end. Different progra weighed these criteria differently. For example, there w some dispute about whether mined sodium nitrate should permitted as a fertilizer because, although it is highly soluble a contributes to soil salinization, it is a useful source of nitrogen cold weather and is important for many organic growers. As 1998, 5 of the 18 programs prohibited the use of sodium nitra and 11 more allowed it with restrictions; two programs allow it to be used with no restrictions. We tracked certifie judgments for 13 specific crop-production materials; we fou significant differences in the regulations pertaining to six these materials. The National Organic Program is consistent wi most organic certifiers. Where there are differences in regu tions, the NOP tends to prohibit more of the materials we track than did other programs. There was also some disagreeme about the relative importance of materials regulations. As stat earlier, organic production is often defined as a system th enhances soil health, but another definition is a system th avoids certain materials. Different programs emphasized o concept or the other, which resulted in a different focus in t standards. Programs that emphasized the former concept (t 'ecology-based' or 'plan-based' approach) might require t producer to submit an organic plan focusing on practices th build soil quality, while those that emphasized the lat ('materials-based' or 'list-based') might focus more on lists allowed and prohibited materials. Fifteen years ago, so organic certifiers placed more emphasis on such list-bas certification (J. Gillan, New England Small Farms Institu Belchertown, Massachusetts, personal communication, Ap 1998) but we found 15 of 18 certifiers, including the larg programs, stressed a plan-based approach. The National Orga Program similarly uses a plan-based approach.

We also found that certifiers frequently regulated materials similar ways. As noted above, an industry-based survey of organic certifiers (OCC, 1998) suggested that some certifi view organic agriculture as a 'constantly improving system a standard' rather than a set of absolute guidelines. We found c expression of this concept in certifiers' guidelines for materia Seven certifiers included in their Materials List a category 'regulated' or 'restricted' substances, and stated that producer must reduce the use of these restricted materials o time (some programs had the 'restricted' category but did force producers to reduce their use). This is how some certifi

encouraged producers to make continuing improvements in their management systems. The National Organic Program does not use this type of approach.

Organic crop management. Crop management requirements were broadly similar across certifiers. All programs required producers to submit an organic plan annually; most used it as the primary tool of certification. Programs required the same type of information in the plan, such as land history and neighboring land uses. Fourteen programs required producers to use crop rotations for annual plants, though they varied in how they prescribed these rotations: some programs suggested permissible rotations, while others only said that some rotation is required. All the programs compared required a 3-year transition period between the last application of a prohibited material and the harvest of the first certified organic crop. Twelve of the 18 programs allowed producers to sell their products in the intervening time with labels such as 'certified transitional organic' or 'certified transitional'. All 18 programs allowed farms to operate organic and conventional fields in the same farm if they met additional organizational requirements. However, seven programs said they required or encouraged eventual conversion of the whole farm to organic methods. The facet of crop production where there was most disagreement concerned unintentional contamination of organic crops by prohibited materials. Programs varied significantly in approaches to prevention, detection, and remedies. Approaches to prevention were most similar. Fifteen of the 18 programs required organic fields to have a buffer zone on borders they shared with land where prohibited materials may be a concern, such as roadways or conventional farmland. The buffer zone most often meant simply a separation in space, usually a 7.6- or 15.2-m (25- or 50-foot)-wide strip of land; some certifiers also required physical barriers or means to divert potentially contaminated runoff (certified farmers could grow crops in buffer zones but the products could not be labeled as certified organic). Another possible avenue of contamination is from irrigation water, but only six certifiers (including just three of the six large private programs) always required producers to test irrigation water for prohibited materials. Since all certifiers required producers to document the source of irrigation water—and presumably could require tests if warranted—it is difficult to tell how often certifiers acted with regard to contaminants in irrigation water. However, the fact that only six programs mentioned the issue indicates that some certifiers might not have considered it at all.

In general, the standards indicate that certifiers acted somewhat aggressively to encourage farmers to prevent contamination by drift or runoff. Testing for contamination seemed to occur less frequently. Only six certifiers tested crops regularly for residues of prohibited pesticides or fertilizers. This paucity of regular testing was probably partly due to the expense involved; indeed, four of the six certifiers that tested regularly were state-run programs that more likely had the resources to subsidize testing. The lack of regular testing may also stem from the understanding that organic certification is the certification of a process (i.e., how the product is grown or produced) rather than the product itself. However, all 18 programs reserved the right to test crops if they suspected residues, and almost all programs had fixed limits for synthetic residues that organic products could not exceed.

If the certifier concluded that contamination was caused by a farmer using prohibited materials (i.e., it was 'intentional'), then the farm was decertified and legal action might be taken. Where contamination was unintentional, the crop and/or land might be decertified, depending on the source and level of contamination and the certifier. If the contamination was from drift, five certifiers in our comparison automatically decertified affected crops, regardless of the level of drift or residue. Three of these five also decertified the land on which the crops were growing, though it is unclear whether the land would need to pass through the 3-year transition time again before the next organic crop could be harvested. Most certifiers did not automatically decertify but did require residue testing.

Fourteen certifiers stated that produce with residues of prohibited materials (such as synthetic pesticides) above a certain level could not be certified organic. This level varied among certifiers: 10 programs set the level at 5% of the US Environmental Protection Agency (EPA) tolerance level of the chemical (or 100% of the Food and Drug Administration (FDA) action level, if there was no EPA rating), while four programs used 10% of the EPA tolerance level. Two more certifiers automatically decertified crops with any detectable level of residue if the contamination was from drift, but did not set a limit on residues if the contamination was from historically contaminated soil (such as one might find in an old, converted apple orchard).

The National Organic Program standards for crop production are consistent with those of the certifiers in this comparison and are not particularly more or less strict. The NOP requires producers to submit an organic plan, including plans for crop rotation. It requires the same 3-year soil transition time, though it does not permit 'transitional organic' labeling. Like the majority of certifiers, the NOP does not require regular residue testing of produce or soil, but it does require preventative measures such as buffer zones and runoff diversion. In the event of unintentional contamination or drift, the NOP requires crops to be tested for residues but does not require soil tests—again, like the majority of certifiers. Finally, the NOP is in line with certifiers in this comparison with respect to allowable levels of prohibited substances. The NOP does not permit produce to be sold as organic if it contains residues that exceed the FDA action level or 5% of the EPA tolerance. Like two programs in our comparison, it does allow exceptions if soil is historically contaminated, although the Final Rule includes no firm guidelines on what level might be permitted from such background contamination.

Organic livestock production. The philosophy of organic livestock production is to maximize the health of livestock animals while avoiding the use of synthetic materials. In addition, consumers may expect organic livestock products to contain fewer residues of synthetic animal drugs and may expect organic animals to be treated more humanely. Thirteen of the 18

standards we compared involved standards for organic livestock production, including two state programs, all six large private programs, and five small private programs. We identified five main sections in livestock standards: guidelines for sources and conversion times for organic animals; housing; feed requirements; healthcare; and methods of enforcement and record keeping. Programs frequently had different guidelines for poultry, dairy mammals, and slaughter mammals, so we discuss these separately. Until March 1999 the USDA's Food Safety and Inspection Service prohibited organic labeling on meat products. This prohibition was lifted when the USDA announced that the Meat and Crops Grading Branch of the Agricultural Marketing Service would serve as an accreditor for organic certifiers wishing to certify organic meat (FSIS, 1999). Nevertheless, as of 1998 all 13 organic certifiers in this survey that had standards for any livestock products also had standards for organic meat production. Organic certifiers had been developing meat certification guidelines for several years despite the federal prohibition on organic meat labeling.

Most of the certifiers in our survey (8 of 13) required that slaughter mammals be in organic management from birth in order for the meat to be labeled certified organic. The other certifiers allowed slaughter mammals to be converted to organic production at any age, and almost all required a 1-year conversion period. That is, these programs required slaughter mammals to be kept in organic management for 1 year before their meat could be sold as 'certified organic'. For dairy animals, the standard time required to convert animals to organic production was 1 year. Ten of the 13 programs required a full year of 100% organic feed, and seven programs required a full year of organic healthcare practices, before dairy products could be labeled certified organic. Other certifiers required shorter conversion times for dairy animals, ranging from 3 to 9 months for feed requirements and from 1 to 9 months for healthcare. In the case of poultry for meat (broilers), all 13 programs required birds to be in organic management from at least the second day of life. Seven of the 13 programs (including five of six large private programs) required egg birds (layers) to be in organic management from at least their second day in order for the eggs to be certified. The other six programs allowed layers to be converted to organic production after a conversion period ranging from 30 days to 6 months. In comparison, the National Organic Program requires slaughter mammals to be raised organically from birth, dairy animals to be raised organically for 1 year, and broilers and layers to be raised organically from the second day of life, in order for the meat or other products to be certified organic. The NOP, like 7 of the 13 certifiers in our survey, has an exception for 'whole-herd conversion', which allows a one-time, partial relaxation of organic feed requirements when an entire herd of dairy animals is converted to organic production.

In livestock housing systems, certifiers generally required that organic animals be given appropriate housing to maximize their health. A common requirement was that housing should allow 'natural light, fresh air and comfort behaviors suitable to the species and stage of production', but how certifiers applied this requirement is unclear. For instance, it seems to leave open the question of whether animals must have routine access to indoor or outdoor exercise areas and to pasture. Because of this ambiguity, we compared whether certifiers explicitly state these requirements.

For slaughter and dairy mammals, 11 of 13 programs required access to indoor or outdoor exercise areas (weather permitting). Six programs required that slaughter and dairy mammals have daily access to outdoor areas, weather permitting; three programs explicitly required that this outdoor access include green pasture. Some certifiers also had requirements for what type of confinement was permitted. Two certifiers required that animals be given free access to a non-cement floor when they are indoors for long periods of time. Nine certifiers explicitly prohibited routine or extended indoor confinement, while 1 explicitly prohibited confinement for the duration of the animal's life.

For poultry, 8 of 13 programs required that birds be given routine access to outdoor areas when weather permits. Only one program required that birds have routine access to green pasture. (No programs required that poultry have daily access to the outdoors when weather permits.) Some programs had special guidelines for confinement: for instance, eight programs explicitly prohibited housing birds in fixed cages indoors. Four programs explicitly prohibited lifetime confinement indoors, while two explicitly allowed lifetime confinement indoors as long as the birds were not confined in cages. It was somewhat common for programs to set a requirement of a minimum amount of floor space per bird; seven programs set such requirements.

Overall, there was significant divergence in standards for livestock housing. The National Organic Program tends toward the strict side of the spectrum in some respects, and toward the less strict side in others. For slaughter and dairy mammals, it prohibits routine confinement and requires access (but not daily) to the outdoors, weather permitting, and to green pasture. For poultry, the NOP again requires routine but not daily access to outdoor areas and prohibits lifetime confinement. Like the majority of programs in this comparison, the NOP prohibits the use of indoor, fixed cages to house poultry.

There was more consistency among certifiers with respect to feed requirements. Twelve of the 13 programs required that 100% of the feed given to organic animals be certified organic; one program moved to 100% in its 1999 standards. Nine programs had special provisions for producers to follow when a 'feed emergency' made certified organic feed unavailable in sufficient quantity. In this event, the certifier could grant the producer permission to use certified transitional-organic feed, feed that was organic but not certified, or as a last resort conventional feed. Six of these nine certifiers had some method of limiting the amount of emergency non-certified feed that could be given, either a time limit on how long a producer could claim a feed emergency or a limit on the annual percentage of feed that could be allowed as emergency feed. One certifier required producers to note on product labels if non-certified

organic feed had been given as a result of a feed emergency. The National Organic Program requires livestock to be fed 100% certified organic feed and suggests that organic grain is available in sufficient quantity that emergency provisions are not necessary (AMS, 2000b). It does allow the administrator of the Agricultural Marketing Service to approve temporary variances.

Another aspect of feed requirements is the allowed proportion of concentrates (high-nutrient feeds) to roughage (low-nutrient feeds). This is a concern for organic certifiers because of evidence that excessive concentrates can diminish animal health (Macey, 2000). In our survey, just 2 of 13 programs had quantitative limits on the proportion of dry matter intake that could come from concentrates. Three more programs required producers to offer roughage as a free-choice food or prohibited a 'hot' dairy or poultry ration with excessive concentrates. The fact that only 6 of the 13 programs (including just three of the six large private certifiers) limited high-concentrate feeding may indicate that this was an issue that certifiers dealt with more in terms of overall animal health, preferring to avoid being overly prescriptive in written standards for feed. Another possibility is that livestock standards were relatively undeveloped in this area in the late 1990s. In comparison, the NOP addresses the issue of concentrate use only through its requirement that some types of animals be given access to pasture; it has no other stipulations about avoiding excessive concentrates. Although the NOP is in the process of developing more detailed guidelines for managing ruminant production operations, it is unclear whether these will address the issue of concentrate-roughage balance in feed.

Programs also had largely similar healthcare requirements. All the programs in this study stated that preventative care should be the first line of defense against disease. Eleven stated that withholding treatment from a sick animal was grounds for decertification. This is generally an issue when an animal has a malady that cannot be adequately treated by organic-approved methods, so that producers must use remedies that are ordinarily prohibited. If prohibited remedies were used, producers were required to withdraw the affected animal from organic production temporarily or permanently. However, the required withdrawal time varied by certifier. Withdrawal periods were generally specified as the greater of two durations: a multiple of the time required by the FDA for the specific medication or an absolute amount of time. For slaughter animals, nine certifiers required permanent withdrawal from organic production if animals had been treated internally with a prohibited antibiotic. The four certifiers who allowed meat animals back into organic production following such use specified withdrawal periods ranging from 30 days (or twice the FDA requirement) to 1 year—a fairly large range. For dairy animals, 3 of the 13 certifiers did not allow animals to be brought back into organic production at all if the producer administered a prohibited antibiotic. Withdrawal times for the other 10 certifiers ranged from 12 days (or twice the required FDA withdrawal time) to 1 year. A similar range of requirements applied to application of prohibited parasiticides. All programs prohibited the routine use of subtherapeutic doses of antibiotics, a practice used in conventional livestock operations to promote weight gain, prevent disease, or both (Food Marketing Institute, 2000).

As was the case with conversion times, housing, and feed, the National Organic Program tends toward the strict end of the spectrum of certifiers studied, but is not the strictest. Like most certifiers, the NOP states that preventative care is the first line of defense against disease, and that the failure to treat sick animals may lead to decertification. If synthetic antibiotics or parasiticides must be used, the NOP requires that slaughter animals be removed from organic production permanently and that dairy animals be removed from organic production for 90 days. However, the NOP does not currently allow any synthetic antibiotics under the National List.

Organic processing and handling. In processing, organic certification refers to the way the ingredients of a processed food are produced, as well as the processing facility and methods. Processing includes cooking, drying, mixing, fermenting, freezing, or other manufacturing that alters the flavor, keeping quality, or any other property of the food. Food and fiber handling is the process by which food is stored, shipped, packed, repacked, brokered, or otherwise transferred in its travel between the producer and the consumer. (Technically food processing is a subset of handling, but we use the term 'handling' to indicate handling other than processing.) When a processor or handler applies for organic certification, the certifier is generally concerned with three aspects: dilution of the final product with non-certified ingredients; contamination with toxins, residues or prohibited additives; or degradation of the food 'by allowing the integrity of the food to be altered by the manufacturing process' (OFPANA, 1992). Applicants must demonstrate that they have adequate physical facilities, employee training, management abilities, and record-keeping systems. Sixteen of the 18 programs we surveyed had standards for organic processors and seven had detailed standards for organic handlers. Most programs set up a three-way classification for processed foods that was directly related to product labeling. Products with the highest percentage—often 95–100% organic ingredients—could be labeled as 'certified organic [product]' on the principal display panel (PDP), for example, 'certified organic cereal'. A second category allowed products with a high percentage of organic ingredients to be labeled 'made with organic [list of ingredients]' on the PDP, such as 'cereal made with organic wheat and raisins'. Most certifiers allowed a third category of labeling for products with a smaller percentage of organic ingredients. In this case certifiers usually did not permit a reference on the PDP to the organic content, but did allow a less prominent label claim, such as identifying on the ingredient list which ingredients were certified organically produced. Some certifiers also permitted additional claims on the side panel, separate from the ingredient listing; for example a producer might include a paragraph explaining that the cereal contains certified organic

dates and raisins. Where products bear only one label, certifiers equate the most visible part of the label with the PDP and the side parts of the label with the side panels.

Some differences among certifiers arose in the guidelines for product composition for each labeling category. We tracked the following types of product composition guidelines: the percentage of organic ingredients required for each category, regulations on non-organic and non-agricultural ingredients, and preservation of nutritional quality in processing. We refer to the three labeling categories outlined in the preceding paragraph as 'organic', 'made with organic', and 'contains organic ingredients'. Depending on the certifier, these categories corresponded to somewhat different proportions of organic ingredients. All but one certifier required products to contain 95–100% organic ingredients in order to be labeled 'organic'; the remaining certifier allowed such labeling for products with 90–100% organic ingredients. Six certifiers required products to contain 50–95% organic ingredients in order to be labeled as 'made with organic ingredients' on the PDP, while three certifiers required 70–95% organic ingredients and the remaining seven had no guidelines for this category. Of the nine certifiers with guidelines for the 'made with organic' label, all allowed products with some organic ingredients but less than the minimum (50% or 70%) to be labeled as 'containing organic ingredients' on the side panel. However, one of these nine certifiers did not permit the use of its name on the label, even if it certified the ingredients.

Most certifiers encouraged producers to use as many organic ingredients as possible in a product; 11 of the 16 certifiers required processors to use organic ingredients when they were available, including using more organic ingredients over time as they become more available. Certifiers regulated fairly strictly the ingredients in products labeled 'organic' and 'made with organic': all of the programs with specific guidelines for these categories had at least moderately detailed lists of permitted ingredients and stated or implied that ingredients not on these lists were prohibited. We did not make side-by-side comparisons for most ingredients but all 16 certifiers prohibited the use of irradiated ingredients in processed foods labeled 'organic', and all but one prohibited the use of ingredients made with genetically engineered organisms (GEO). Ingredient guidelines were somewhat less restrictive for foods labeled as 'containing organic ingredients' on the side panel. Of the nine programs with detailed guidelines for foods in this category, four suggested that processors were allowed to use any ingredient in these foods, except—for two of the four certifiers—ingredients that were irradiated or made with GEO.

In addition to ingredient guidelines, organic certifiers required applicants for processing certification to meet guidelines for storage, transportation, record keeping, and other aspects of facility management. Fifteen of the 16 certifiers with processing standards required processors to follow the same guidelines regardless of whether they handled products in the 'organic', 'made with organic', or 'contains organic ingredients' category. All 16 certifiers allowed certified operations to produce bot conventional and organic products, as long as the facility me additional organizational requirements.

Organic certifiers were fairly aware of current trends in foo safety and quality assurance: 11, including all of the six larg private programs, required producers to include elements of th Hazard Analysis Critical Control Point (HACCP) concept in th organic plan, and one certifier recommended that producer comply with ISO 9000, a comprehensive quality assuranc system administered by the International Organization fc Standardization. We use two indicators to track how organi certifiers ensured that processed products did not contai prohibited residues. Eleven of the 16 certifiers allowe processors to use prohibited materials to fumigate the area where organic ingredients or products might be stored c processed, but 10 of these 11 required producers to keep organi products out of fumigated areas for a longer period of time tha the fumigant label required. Five programs had provisions fc regular residue testing of processed products to check the level of prohibited materials in the final product. As with crop residu testing, all 16 programs stated they would test products fc residues if concern were warranted.

Eleven of the 16 certifiers with processing standards state that minimizing environmental pollution from agriculture shoul be a goal of organic production; 6 of these 11 required tha organic processors minimize packaging used in certified organi products and two required that organic processors submit a pla for ecological waste management for the facility. Nine certifier stated in their principles that organic producers should preserv food quality during processing but only two of these emphasize this as a guideline in their processing standards. These apparer inconsistencies may have been due to the relative newness c organic processing standards or to certifiers' desire to avoi being overly prescriptive in the rapidly growing market fc processed organic foods.

Seven of the certifiers in our survey, including three of the si large private programs, had detailed guidelines for the certifica tion of organic handlers. All 16 programs with processc standards required processors and handlers to maintain an aud trail of receipts, yield statements, and other documents sufficier to track raw materials from the supplier to the retail market. C the seven programs with detailed standards for handlers, si stated that when a product or ingredient was transferred fror one party to another, both the seller and buyer had to keep record of the volume of product exchanged. Like the require ment for an audit trail, this tool may have minimized th potential for fraud in organic labeling. None of the seve programs with detailed handler standards (nor any other certifi in our survey) required that farmers or other producers who se their products to another supplier do so only via a certifie organic handler. There were probably two main reasons for thi First, handler certification was (and still is) fairly new, and ther were relatively few certified organic handlers (Dimitri an Richman, 2000). Secondly, certifiers were primarily concerne with the production process, rather than with the handling c products after they left the control of the producer.

Table 4. Labeling guidelines for multi-ingredient processed foods.

Category of organic labeling	Certifier name allowed on PDP[1]	Certifier logo allowed on PDP[1]	Certifier name allowed on label but not on PDP[2]	Certifier logo allowed on label but not on PDP[2]	Individual ingredient identification (on side panel)	Percent organic ingredients (on side or front panel)
Organic	16/16	16/16	0/16	0/16	Required: 5 Optional: 11	Required: 3 Optional: 13
Made with organic ingredients	4/9	0/9	4/9	4/9	Required: 6 Optional: 3	Required: 4 Optional: 5
Contains organic ingredients	0/9	0/9	7/9	1/9	Required: 6 Optional: 2 Prohibited: 1	Required: 4 Optional: 4 Prohibited: 1

[1] The numerator indicates the number of certifiers who permitted (or required) the use of their name or logo on the principal display panel (PDP) of the label for each labeling category. (In all cases, certifiers who permitted their name or logo on the PDP also allowed it elsewhere on the label.) Denominators vary because some certifiers did not have comprehensive guidelines for some labeling categories.

[2] The numerator indicates the number of certifiers who permitted (or required) the use of their name or logo only on a side panel of the label; that is, on the label but not on the PDP. Denominators vary because some certifiers did not have comprehensive guidelines for some labeling categories.

The processing guidelines of the National Organic Program are generally clearer than those contained in the programs we compared, but overall they are not significantly more or less strict. The NOP has separate labeling guidelines for '100% organic' products; otherwise, the NOP requires 95–100% organic ingredients for the 'organic' product label and 70–95% for the 'made with organic ingredients' claim; when fewer than 70% of the ingredients are certified organic, ingredients may be identified as organic in the ingredient list but additional statements may not be made, except for identifying the percentage of organic ingredients on the side panel (as in the preceding discussion, we refer to products in this category as 'containing organic ingredients', although the NOP does not allow that phrase to be used on these products). Like the majority of certifiers, the NOP encourages processors to use organic ingredients when they are available. A less strict aspect of the NOP is that any ingredient may be used in products in the 'contains organic ingredients' category, even one that is irradiated or made with GEOs. This trait is shared by only two of the certifiers in our comparison. The facility management requirements of the NOP are generally consistent with those of other certifiers, as are the handler guidelines; but NOP's handler standards are much clearer than in most programs we compared.

Organic labeling guidelines. Since most producers and certifiers see organic certification as a marketing tool that communicates to buyers along the supply chain and to consumers, labeling guidelines are one of the most important sections in certification standards. Many certifiers required producers to include certain statements on labels; most certifiers also prohibited certain phrases on labels. In addition, ten certifiers in our survey required producers to submit their product labels for approval before the product could be sold. At least four of the certifiers who required pre-approval of labels certified 50 or more processors; thus this requirement was not only used by small certifiers but large ones as well. For unprocessed foods we focused on two issues: transitional labeling and labeling of non-retail containers. Twelve of the 18 certifiers allowed products to be labeled 'transitional organic', 'certified transitional', or some variant if the product met all requirements for certification except the 3–year transition time. Transitional labeling may make the transition to organic production less expensive, since consumers may be willing to pay a premium for 'certified transitional organic' products (though not as high as the premium for 'certified organic'). However, it may lead to confusion in the marketplace, if consumers do not understand the difference between the labels. Three of the certifiers in our survey addressed this issue by prohibiting the word 'organic' in the label claim for transitional product. In addition, only one certifier allowed 'certified transitional organic' product to carry the same logo as 'certified organic' product. In comparison, the National Organic Program does not allow transitional-organic certification, concluding that 'it is unclear what marketplace value such a label might have, and we are concerned that allowing such a label at this point might lead to greater consumer confusion rather than providing clarity' (AMS, 2000b).

Labeling of non-retail containers may help to guarantee the integrity of organic products through the handling chain. Ten of the 18 certifiers required products to be identified as 'organic' on the invoice or the container; seven of these also required the name of the certifier to appear on the invoice or the container. The National Organic Program does not require non-retail labeling; perhaps because the NOP staff feels that mandatory certification of handlers will provide the same guarantee of organic integrity through the handling chain.

We discuss label requirements for multi-ingredient processed foods in the context of the three labeling categories presented earlier. For each category, we compared guidelines for the use of

the certifier's name and logo on the principal display panel (PDP) or elsewhere on the label, in addition to guidelines for identifying organic certification in the ingredient list and indicating the percentage of organic ingredients (Table 4). There was substantial agreement about where certifier names and logos were allowed, except for products labeled 'made with organic ingredients'. Certifiers were split on the questions of mandatory identification of organic ingredients in the ingredient list and whether the percent of organic ingredients should be indicated on the label.

The National Organic Program would allow 'organic' products to use both the USDA organic logo and the certifier name and logo on the PDP. Products in the 'made with organic' category could use the certifier logo anywhere on the label but could not use the USDA organic logo at all, and products in the 'contains organic ingredients' category could not use the certifier logo or the USDA logo anywhere on the label. The NOP effectively summarizes the labeling requirements that existed among US certifiers, at least as expressed in this survey. The NOP requires individual ingredient identification in the first two labeling categories (unless the product is 100% organic) but considers it optional for the last (although if products in the third category do not have individual ingredient identification, then the word 'organic' will not appear on the label at all). The NOP makes percentage labeling optional in all categories.

Certification program management. The quality or stringency of standards is meaningless unless standards are applied and administered effectively. Therefore, we also compared certifiers' administrative guidelines. We had difficulty obtaining some certifiers' policies because they were reluctant to release them or they used unwritten policies on some issues. It was also difficult to evaluate how strictly certifiers followed their written policies. In at least one publicized case, organic labeling fraud occurred despite the certifier's written conflict of interest policy because not all personnel followed the policy (Mergentime, 1997). We compared aspects of policies related to the confidentiality of applicants, conflicts of interest, unannounced inspections, decertification, and appeals. Confidentiality and conflict of interest policies were nearly universal. Fifteen of the 18 certifiers had written policies that forbade certification personnel to disclose certain kinds of information about certified operators; two more certifiers had unwritten policies to this effect. Twelve of the 18 programs had a written policy that prohibited inspectors and decision makers (such as certification committee members) from having financial interactions with certified applicants within 1 year before or 1 year after a certification decision. Four more said they had an unwritten policy to the same effect. Another concern for the integrity of organic certification claims is whether producers represent their operations accurately; one way certifiers can check is to perform an unannounced inspection of some or all applicants. (All the certifiers in our survey inspected operations at least once per year, but this inspection was scheduled in advance.) Eight programs, including five of the six large private certifiers, said they perform unannounced inspections of applicants regularly, either at random or for operations where the certifier felt there was reason for concern. One program also performed a unannounced second inspection on all first-time applicants. A of the programs reserved the right to make unannounce inspections at any time, and all said they would investiga any allegations that a certified producer had violated certification requirement. However, one certifier gave operato 24-hour notice before all inspections, even 'unannounce inspections. If an inspection or some other event resulted i the decision to decertify an operation, all the certifiers in ou survey had a process by which operators could appeal th decision.

The National Organic Program requires certifiers to hav written policies to prevent financial conflicts of interest betwee producers and inspectors or decision makers, by bannin financial interactions for 1 year before and 1 year after th certification decision. The NOP also requires certifiers to have confidentiality policy adequate to protect certified operators. does not require certifiers to perform unannounced inspectio on any operations, unless they see reason to do so. A feature the NOP that sets it apart from the certifiers in our survey is tha in order to prevent conflicts of interest, it prohibits certifiers fro giving advice to applicants and certified operations about how t overcome identified barriers to certification. Although we did n compare this aspect specifically, our understanding is that in th old system many certifiers did offer advice during th certification process about overcoming identified barriers.

Comparing the 18 programs to three national an international programs. We included three additional pr grams in our survey: the American Organic Standards and th National Organic Program, both of which were written standards with which all certifiers would comply; and the Bas Standards of the International Federation of Organic Agricultu Movements (IFOAM), a major European organic organizatio IFOAM is important in the US because several US certifiers a accredited by an organization affiliated with IFOAM. Th Organic Trade Association's American Organic Standar (AOS) are intended to represent an industry-based consens of US standards. They were written in part as a baseline wi which OTA members (including most US certifiers) mu comply. Compared to most of the 18 US programs analyze IFOAM's Basic Standards are generally broader-reaching describing the goals of organic production, often but not alwa more lenient about specific guidelines, and more stringent requirements for administrative procedures. For instanc IFOAM standards require operations with parallel organic a conventional growing systems to convert eventually to fu organic production, require environmental practices such water conservation and minimization of packaging for processe products, and suggest that livestock animals should be fed fro feed produced on the farm. On the other hand, IFOAM requir only a 12- or 18-month transition time for soil for cr production, does not impose an absolute limit on residues prohibited materials in products, and has shorter conversi times for animals brought into organic production. In part, the less exacting requirements reflect the fact that these are 'bas standards', allowing country-to-country differences in keepi

Table 5. Key points in comparison of certification programs.

Similarities

Overall, the 18 standards compared were substantially similar in the methods and standards for organic certification. Similarities included

- Primacy of the organic plan in making certification decisions
- Systems of regulating materials, including criteria used to judge materials for organic acceptability
- Most aspects of crop production standards
- General conception of organic livestock production as maximizing animals' health, including some specific aspects of livestock production standards, such as the requirement for 100% organic feed
- General allowances for product composition for multi-ingredient foods
- Requirements for organic handling, where programs had such standards
- Some aspects of labeling guidelines
- Most aspects of administrative procedures

Differences

Areas with substantial differences included:

- Goals of organic production and how goals were put in practice
- Restrictions on some materials permitted in crop production
- Livestock housing, health care, feed, and conversion times
- Completeness of standards for organic handlers
- Residue testing: most certifiers set limits on pesticides or other prohibited materials that could be in certified organic food, but few conducted regular residue tests
- Allowed and prohibited statements on product labels, including differences in when logo or name of certifier could be used on some multi-ingredient products
- Standards for transitional organic production, including use of 'certified transitional organic' or similar label
- Possible deviations between written and enforced standards

with what IFOAM views as the site-specific nature of organic farming. In general, IFOAM's more flexible standards probably allow a larger set of producers to meet organic requirements. Since many certifiers see organic production as a continually improving system, IFOAM's approach might be viewed as equally valid when compared to the standards of most US certifiers.

The American Organic Standards are generally far-reaching in their goals and exacting in their specific requirements. The AOS are generally at least as strict as the standards in this comparison; in some aspects they are more strict than most. For instance, the AOS requires livestock producers to give slaughter and dairy animals daily access to pasture, a requirement shared by only three of the certifiers in our comparison. The AOS also requires a longer than usual withdrawal time after dairy animals receive an internal antibiotic and would require that, by 2003, if an antibiotic must be used then the animal must be permanently removed from organic production. Other than these and a few other cases where the AOS are stricter than most standards, the AOS differ primarily in that they contain more thorough explanations and descriptions.

Overall, the National Organic Program tends toward the stricter end of the spectrum of certifiers compared here. Most elements of crop production standards are similar to the 18 certifiers compared, as are most requirements for livestock conversion, housing and pasture, feed, and healthcare. The NOP guidelines on product composition for multi-ingredient processed foods, and on handler certification, are clearer and more detailed than those of many certifiers. The NOP provisions on labeling are also consistent with those of most certifiers. In some places the NOP is significantly stricter than most standards in the old system, as is the case in its provisions prohibiting certifiers from giving advice about overcoming identified barriers to certification. The main aspect we identified where the NOP is significantly less stringent is that it describes a more limited version of the goals of organic production than many certifiers in this survey. The NOP's provisions for some aspects, such as livestock pasture, may not be consistent with some consumers' beliefs about what organic production is or should be, but do appear to be generally consistent with the spectrum of standards compared here.

How diverse was the organic certification system in the 1990s? Our detailed comparison suggests that, while there was considerable variation in standards, labeling guidelines, and administrative procedures among the organic certification systems in use during the late 1990s, most of the differences were relatively minor, except in the area of livestock production (Table 5). We believe the observed differences in standards arose from three main sources. First, some certifiers—especially smaller ones—may not have found it worthwhile to write complete standards for approved, regulated, and prohibited practices, preferring instead to deal with situations as they arose. Many certifiers, both large and small, had slow processes for revising standards—whether because of small staffs, limited resources, democratic (but slow) review processes, or a failure to use information technology effectively. For example, many certifiers, including several of the largest, could not give us an exact number for their certified growers, processors, and handlers because they had no computer database of their certified operators. This suggests a second reason for disparities in written standards: with limited resources, certifiers put different priorities on bringing their written standards up to date with current working policies. Finally, some differences in

standards reflected actual differences in practice, as certifiers held different beliefs about the defining features of organic production, how diverse goals of organic production should be prioritized, and how those goals should be operationalized. It is also important to remember that differences in standards may have been narrower or wider in practice, based on how they were applied and enforced.

III. Likely Impacts of the National Organic Program on Markets for Organic Products

The US has moved to a new system of certification that features a national standard under the National Organic Program (NOP). Our detailed comparison of the range of organic standards in use in the late 1990s provides a basis to evaluate the likely impacts of this change on several features of markets for organic products.

Clarity about standards among buyers

The major cost attributed to the old, decentralized certification system was confusion among consumers and in the supply chain about what 'organic' meant. Proponents of a uniform national standard argued that it would facilitate the market for organic products and increase sales. On the whole, we did not find large variations among organic certification programs in terms of the characteristics of the programs that are likely to be important to consumers and other buyers. However, there were some key areas of difference between standards. The single area where certifiers were most different was in livestock standards. For example, most programs in this comparison had limited requirements for the pasturing of livestock animals. If some consumers believe that organic livestock are required to be free ranging, then under some standards they may have been misled about the meaning of organic meat and dairy products. The NOP is generally on the stricter end of the 1990s spectrum of standards, so it may better align standards for organic livestock production with consumer expectations but, as noted above, it may not meet all consumer expectations.

A second major difference was how certifiers treated the issue of pesticide residues in organic foods. Growth in demand for organic foods may be fueled in part by consumers' belief that organic foods contain lower pesticide residues. However, organic production was generally defined as an integrated system of environmentally sustainable production, rather than a system that aims primarily to produce foods with lower pesticide residues. Although our comparison suggests most certifiers prohibit organic labeling of foods with pesticide residues above a certain level, only one-third of the certifiers test for residues regularly. If low pesticide residues are a primary reason that consumers buy organic products, then some consumers may have been misled about the extent this was assured under different organic certification programs. This situation will not change substantially under NOP.

A final difference was in how certifiers set out goals for organic production that were not directly related to food production. While some certifiers suggested goals such as providing a safe environment for farm workers, improvin wildlife habitat around the farm, or creating a regionally base food system, others defined organic production exclusively i terms of not using prohibited materials. In addition, certifie implemented these goals to different degrees. These difference may have been meaningful for some consumers and othe buyers.

The National Organic Program may eliminate some confusio in regard to these areas of difference. The new system continue to feature numerous certifiers but the USDA, or its agen accredits them. Use of the term 'organic' on a product lab requires the producer to be certified, except for very sma producers. The single, baseline standard and the use of standardized label are likely to reduce confusion amon buyers regarding what it means to be 'organic'. The success the national standard in supporting the market for organi products will ultimately rest on how well it matches th demands of consumers and other buyers. A uniform standar that requires practices that they view as important (e.g pasturage requirements for livestock, residue testing of product will facilitate market growth, while a standard that misses th mark may not.

Transaction costs for certifying multi-input products

A second cost attributed to the decentralized certificatio system was higher transaction costs for producing products th required certification by more than one certifier. This coul occur with multi-input processed products, livestock produc where certified organic animals were fed certified organic grai and hay, and products that passed through handlers that wer certified by different programs. Because programs differed standards and management, certifiers often required a docume review process before accepting another program's certificatio of an ingredient or handler. Some certifiers had standing mutu recognition agreements that granted automatic recognition handlers or producers certified by the other, but the extent of th mutual recognition was limited. The National Organic Progra will likely reduce these transaction costs because certifiers a required to recognize each other.

Costs of production under standards

A third concern about the decentralized certification syste was that producers would face different costs to be certified du to differences in fees or in the costs of meeting standards. W found some variation in fees, although differences in servic offered may have explained the higher fees of some certifie Our comparison showed some variation in standards amon certifiers but could not quantify the relative costs of meetin those standards. Our judgment is that the actual impact producers' costs was likely to have been small for differences residue testing; moderate for differences in livestock pasturi requirements, handler certification, and the implementation goals; and large for differences in conversion and withdraw periods for livestock and gaps between written and enforc standards. As a whole, differences in costs of production due

different standards may have been significant. With the national standard, such variation in costs should be diminished if certifiers apply the standards uniformly.

The requirement for accreditation of certifiers may serve to narrow or standardize gaps between written and enforced standards among certifiers. Of course, accreditation cannot guarantee that certifiers will enforce their written standards uniformly or with an appropriate level of flexibility, especially if the accreditation system relies heavily on self-reporting by certifiers. To be effective the accreditation agency must have an adequate budget for enforcement and experience with organic certification.

Flexibility of standards

A major benefit attributed to the decentralized certification system was flexibility. First was flexibility for variations in growing conditions and the commercial availability of inputs in different parts of the country. We found that the existence and apparent success of national certifiers, with requirements that were both stringent and flexible, suggests that loss of this type of flexibility is not a major issue in regard to the NOP. A second type of flexibility relates to buyers having choice among standards that placed varying emphasis on different goals of organic production. We found that standards sometimes did reflect different interpretations of what organic means, affording choice among standards regarding their emphasis on environmental quality, lower pesticide use, regional food systems, and other goals. Whether consumers and other buyers had sufficient knowledge to make their choices effectively is a separate question that our comparison could not address.

A final type of flexibility attributed to the decentralized system allowed certifiers to respond more rapidly to changing market conditions and to the introduction of new technologies. Our comparison highlights the response of certifiers to two new challenges: the regulation of genetically engineered organisms (GEO) and of handlers. In both cases, the freedom of certifiers to set different standards apparently allowed them to address these issues in a way consistent with the philosophy of organic production. However, the ability to have different standards also allowed some certifiers to not respond to new issues, which could have undermined the overall credibility of organic products. Our discussions with certifiers also suggested that changing standards could be a slow process for some organizations.

An additional benefit attributed to the decentralized certification system was more local control of standards and policies of certifiers. In some respects the decentralized system offered more opportunities for local involvement in standard setting. Smaller and non-profit certifiers may have been somewhat responsive to reasonable comments offered by knowledgeable, locally based consumers and producers, but for-profit and larger certifiers may not have been so responsive. The NOP will allow more uniform opportunities for democratic involvement, but given the number of interested parties and the slow pace of federal rule-making, the opportunities may be limited. Thus, participants in the organic market who distrust the federal government or who have other reasons for preferring local control are likely to prefer the decentralized system. In addition, in the old system certifiers may have offered services at lower prices as they pursued social goals important to them.

Finally, the new system may force smaller producers and certifiers out of the organic market. Although the new system allows some exemptions for very small producers, small to moderate sized producers, as well as smaller certifiers, may find that the fees associated with mandatory accreditation and certification, as well as increased costs from record keeping and other requirements, make organic production unprofitable. Although state and federal subsidies may mitigate the impact on smaller producers, the Regulatory Impact Analysis issued with the Final Rule acknowledges that the national standards 'may change the composition of the organic industry . . . resulting in a higher concentration of larger firms' (AMS, 2000b, p. 514).

The national standard will largely eliminate the ability of buyers to choose between different standards for what it means to be organic and for organizations to exercise individual control over that definition or compete through their standards. It remains to be seen how the new system compares to the decentralized system in terms of its ability to effectively update the organic standards to meet new conditions and deal with violations of the standards.

Conclusions

The organic products market grew rapidly in the 1990s. During that period the USDA was formulating a rule that would replace the decentralized system of regulation of organic certification and labeling with a uniform, national standard. Under the decentralized system in the late 1990s, over 50 certifiers operated in the United States. We assessed the likely market impacts of the National Organic Program (NOP) by describing the certification system in place prior to its implementation. We compared 18 state and private certification programs, analyzing differences in their standards and labeling. We also compared these programs to three certification programs designed for national or international use, including the NOP.

There were numerous differences in the organic standards in use by certifiers during the late 1990s, but overall we found these differences to be minor. Nevertheless, we found that some of the costs attributed to the decentralized system were probably real. The similarity in standards may not have been evident in the market, given the numerous certification programs in operation and the difficulty of comparing them in detail. This was cause for consumers and other buyers in the supply chain to be concerned about organic integrity, as well as for certifiers to be reluctant to extend recognition to other certifiers.

The possible cost of a national standard is a loss in flexibility and local control. We concluded that there is essentially no change in the way the old and new systems affect certifiers' flexibility for variations in local production conditions. Choice was higher for consumers and other buyers when multiple standards were permitted, although whether information was sufficient to make that choice effective is an open question.

Finally, local control has decreased under the new system and some market participants may prefer the old decentralized system.

A uniform national standard may have a significant impact on the market through increasing buyer confidence, facilitating certification of multi-input products, or facilitating exports. However, federal regulation of certification will likely decrease the flexibility of organic certifiers to place differing emphasis on the multiple goals of organic production, and may also decrease the flexibility of organic standards to respond to changing market conditions and the introduction of new technologies. We will have to await experience under the new regulatory system to evaluate how it performs relative to the decentralized system.

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Changes in farm structure following conversion to organic farming in Denmark

Vibeke Langer

Abstract. *Compared with conventional farms, organic farms are expected to be more diverse, less specialized and less intensive, and as a group contribute to a more uniform regional distribution of farm types. Data on farm size, crop distribution and livestock intensity prior to conversion and planned after conversion on 448 Danish farms, which began conversion to organic farming in 1997, are presented by addressing two questions: (1) what features characterize Danish farms that convert from conventional to organic farming; and (2) do farm types, stocking rates and crop distribution change with conversion? In 1997, dairy farms dominated among the converting farms in hectarage, and a large majority (80–97%) of the farmers of all farm types planned to continue with the same type of production system after conversion. Thus, the regional characterization pattern in organic farm types will be similar to that of conventional farms. Although the total number of livestock units on the converting farms is planned to increase by 6% following conversion to organic farming, they are well below average in stocking rates compared with all Danish farms both before and after conversion. Farmers also plan changes in crop distribution: a 20% decrease in the hectarage for cereal production; a doubling of the hectarage for grassland in rotation; a decrease in hectarage for set-aside, row crops and oilseed rape; and roughage and seeds unchanged. Planned changes in crop distribution differ between farm types. The need to include aspects of diversity and production intensity, on both the farm and the larger scale, in the evaluation of the future direction in organic farming is discussed.*

Key words: conversion, crop distribution, crop/livestock specialization, crop subsidy programs, diversified farming, farm types, livestock intensity, organic agriculture, organic production

Introduction

The expectation that organic farming will be less detrimental to the natural resource base and the environment than conventional farming is an important driving force behind subsidy programs encouraging conversion, as well as consumer willingness to pay higher prices for organic products (Lampkin and Weinschenck, 1996). According to the International Federation of Organic Agriculture Movements and others (Anonymous, 1999; IFOAM, 1999), the goal of organic agriculture is to encourage a method of farming that ensures long-term preservation of the environment and the countryside. Therefore, organic agriculture is expected to exhibit fewer of the traits that have characterized conventional agriculture in industrialized countries during the past four decades, and have contributed to problems affecting the environment (i.e., nutrient losses, soil erosion and the enrichment of water resources, uniformity of landscapes, and impoverishment of flora and fauna). These traits in agriculture are specialization (limiting farm production to few products), intensification (increasing farm input and outputs) and regional concentration of crops and livestock production (Ilbery and Bowler, 1998). Thus, compared with conventional farms, organic farms should be more diverse, less specialized and less intensive, and contribute to a more uniform regional distribution of farm types.

National and European statistics of crop production and animal husbandry on organic farms show that there are large differences between conventionally and organically managed areas (Foster and Lampkin, 1999; Hartnagel and Freyer, 1997; KRAV, 1997; Plant Directorate, 1998). However, such overall crop and livestock statistics do not allow for separating structural differences, i.e., farm type distribution among organic and conventional farms, respectively, from farm-level differences between organic and conventional farms of the same type. The purpose of this paper is to describe how farms change following conversion from conventional to organic farming, by addressing the following questions: (1) what characterizes conventional farms that convert, in terms of farm size and farm type; and (2) what do they convert to, i.e., do farm types, stocking rates and crop distribution change with conversion?

Methods

In the Danish system of certification of organic farms, all farmers applying are requested to describe crop and livestock distribution before conversion as well as planned crops and livestock during and after the conversion period. Individual fields are organic following a 2-year conversion period, and conversion of the whole farm must be completed within a 4-year period. The Plant Directorate inspects all certified farms as well

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as farms under conversion. Data were obtained from all applications submitted to the Plant Directorate for new authorizations as organic farms in 1997 (448 farms), which offer a unique opportunity to link the 'before' and 'after' situation on individual farms. Applications that are submitted to the Plant Directorate contain information on farm size (area owned plus area leased by farmer, minus area rented to others), type and number of livestock on farm before conversion and planned after conversion, crop hectarage the year before conversion began and crop hectarage planned after conversion is completed. The farm's production area includes all rotated land and permanent grassland, regardless of ownership, but not forests or hedges. Since the goal of this study was to describe general trends in changes with conversion of the most common farm types, 16 atypical farms, e.g., mushroom producers, greenhouse farmers with no land, large public land areas producing fodder for recreational herds of deer, as well as farms with incomplete applications, were excluded. Of farms applying for certification in 1997, 7.5% were not found in the lists of certified organic farms in 2000 (Plant Directorate, 2000). This figure includes all cancellations of the conversion process, including transfer of farm ownership or death, indicating that few farmers canceled the conversion process and reverted to conventional production.

Classification of farms

Farms are classified before and after conversion in six farm types, based on livestock density and diversity and dominating livestock type (Table 1). This classification is directed toward discriminating between the main specialized farm types (dairy farms, meat producers, farms with no stock, and pig (*Sus scrofa*) producers) and no attempt is made to distinguish between the different types of mixed farms. The minimum requirement for a commercial livestock enterprise follows the limits established by the Plant Directorate (1997). Changes in farm and field size that may be planned in connection with conversion to organic agriculture are not revealed by the applications.

Classification of crops

Crops grown the year prior to conversion and planned after conversion are recorded in as much detail as farmers information allows, e.g., cereals grown to maturity and cereals for silage are considered as different crops. Crops are grouped into types depending on their use, and on important characteristics including cultural conditions, e.g., duration, sowing time, tillage intensity (see Table 6).

Results

What characterizes farms that convert?

Farm size. Average farm size of the 448 converting farms was 34 ha in 1997, compared with an average conventional farm size of about 40 ha (Anonymous, 1997; Eurostat, 1998). Distribution of farms in size classes shows that among the converting farms, those over 50 ha comprise 64% of the area, which is similar to the national distribution of conventional farms. However, farms larger than 100 ha are slightly less well represented among the converting farms than among all Danish farms (Fig. 1).

Farm type and regional distribution. Among the farms converting in 1997, dairy farms dominated in hectarage (Table 2), whereas those without stock and mixed farms were larger in number but, due to their lower average farm size, only accounted for 22% and 24%, respectively, of the area to be converted. Pig farms amounted to less than 5% in both numbers and area. The distribution of farm types undergoing conversion exhibited regional differences similar to those in conventional farms. In south-west Denmark where conventional agriculture is dominated by dairy farms, these make up almost 60% of the converted area, whereas in the two eastern regions where it is dominated by farms without stock and pig producers, the area of converting dairy farms is less than 10% of converted area. The dominance of dairy farms among converting farms, combined with their concentration in south-west Jutland, resulted in more than half of the total area converting to organic agriculture in 1997 being situated in this region, although it covers less than

Table 1. Definition of farm types based on stocking rate and specialization.

Livestock	Farm type	Stocking rate[2]	Dominant animal
Yes[1]	Dairy	>0.4 LU ha^{-1}[3]	Dairy cows > 2/3 of total LU
	Pigs	>0.4 LU ha^{-1}	Sows + pigs > 2/3 of total LU
	Meat	>0.4 LU ha^{-1}	Beef cattle > 2/3 of total LU
	Mixed	>0.4 LU ha^{-1} but none of the animals contribute with >2/3 of total LU, or 0.1–0.4 LU ha^{-1} of any animal	None
No	Stockless	< 0.1 LU ha^{-1}	None
	Small	>0.1 LU ha^{-1}	None

[1] With livestock, at least one group of animals exceeds limits for commercial livestock production, e.g., three cows (*Bos taurus*), five horses (*Equus caballus*), two sows (*Sus scrofa*), 31 hens (*Gallus domesticus*) or 11 sheep (*Ovis aries*), all with young stock (Plant Directorate, 1997). Fallow deer (*Dama dama*), honey bees (*Apis mellifera*), mink (*Mustela vison*) and horses are not included as livestock.
[2] 1 LU = one livestock unit, e.g., one dairy cow. From 1999 LU has been calculated based on amount of nitrogen in the manure.
[3] ha = production area, i.e., land in rotation plus hectarage with permanent grassland.

third of the total agricultural area of Denmark. Average farm size was closely linked to farm type (Table 2) and therefore also to geographical region, i.e., converting farms were larger in south-west Jutland than in other regions.

Livestock intensity. The 448 conventional farms converting in 1997 were less livestock intensive than conventional farms of the same farm types. For example, converting dairy farms have an average stocking rate between 1.1 and 1.2 LU ha^{-1} (LU = livestock unit), whereas the average stocking rate on conventional dairy farms is 1.5 LU ha^{-1} (Anonymous, 1997).

What do farms convert to?

Changes in farm type and specialization with conversion. Farms classified as dairy, meat, stockless and pigs before conversion are considered to be specialized farms. Among these four farm types a large majority (80–97%) of the farmers plan to continue with the same production system after conversion (Table 3). Among the farms classified as 'mixed', 73% do not plan to make considerable changes, whereas 21% intend to intensify their animal production and become specialized meat, pig or dairy farmers, and only 5% plan a change to stockless farmers. Before conversion 308 farms were classified as specialized farms (dairy, meat, pigs or stockless). After conversion, 319 farms were classified as specialized farms, i.e., an increase of 4% in number of specialized farms and 5% in area. Before conversion, about 13% of farms were diversified with respect to livestock production, i.e., both cattle (*Bos taurus*) (beef or dairy) and pigs, which is similar to Danish conventional agriculture (Anonymous, 1997). With the changes planned after conversion, the proportion is reduced to 11% of the farms. The reduction in farms with diverse livestock production is largely a result of a number of larger farms (mean of 58 ha) with high stocking rates (>1.4 LU ha^{-1}, often comprised of pigs, and dairy and beef cattle) before conversion that plan to exclude pig production after conversion. This decrease in pig production on larger farms following conversion is equivalent to a mean of 430 slaughter pigs and 10 sows per farm, and is only partly balanced by a number of smaller farms (mean of 17 ha) with only cattle before conversion that plan to akso produce pigs after conversion but at a lower intensity (mean of 85 slaughter pigs and 11 sows per farm).

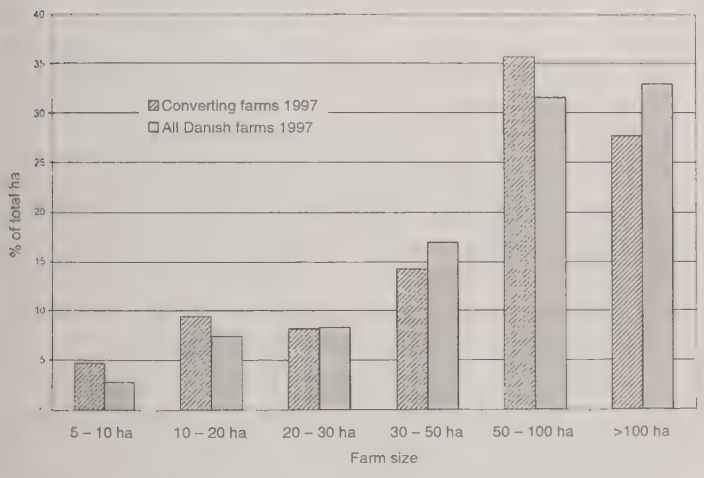

Figure 1. Distribution of 448 farms converting to organic farming in 1997 in farm size classes, compared with all Danish farms. Farms smaller than 5 ha are not included in figures for all Danish farms, and amount to only 1% of the area of converting farms.

Changes in livestock intensity. The total number of livestock units on the farms converting to organic agriculture is planned to increase by 6% (Table 4). The increase in dairy cows contributes about half of the total increase in livestock units, whereas poultry show the largest relative increase, at 98%. However, planned changes in livestock intensity following conversion vary greatly both between and within farm types and regions. Although the total number of dairy cows is planned to increase by 8% with conversion, mean livestock intensity on dairy farms remains unchanged around 1.15 LU ha^{-1} (Table 5). The planned change in livestock intensity after conversion is inversely dependent on the intensity before conversion ($P < 0.001$, df = 1,69), meaning that low-intensity dairy farms tend to increase in intensity, whereas dairy farms with intensities above 1.2 LU ha^{-1} decrease (Fig. 2). The group of dairy farms increasing their stocking rate (40%) have a mean farm size of 93 ha and plan to expand the number of dairy cows, resulting in an increase in the mean stocking rate from 1.00 to 1.14 LU ha^{-1}. The group of dairy farms decreasing their stocking rate (38%), have a mean farm size of 80 ha, and plan to decrease their mean stocking rate from 1.26 to 1.05 LU ha^{-1} by reducing the number of beef cattle and pigs and maintaining the dairy cows.

More than half of the farms (57%) classified as meat producers after conversion plan to increase their stocking rates, from a mean of 0.83 to 1.23 LU ha^{-1}, whereas only 17% of these farms plan to decrease livestock intensity, and 25% plan to

Table 2. Distribution of number and area of farm types among 448 farms converting to organic farming in 1997. Mean production area is based on land in rotation plus permanent grassland, regardless of ownership.

Farm type	Number of farms	Percent of number	Total area of type (ha)	Percent of area	Average production area (ha)
Dairy	71	16	6096	40	86
Beef	58	13	1468	10	25
Pork	20	4	622	4	31
Mixed	110	25	3577	23	33
Stockless	159	35	3361	22	21
Small	30	7	227	1	8
Total	448	100	15351	100	34

Table 3. Planned changes on 448 farms converting to organic agriculture in 1997. The figures in bold indicate the number and proportion of farms in each farm type where no radical changes are planned.

	Type after conversion						
Type before conversion	**Dairy**	**Beef**	**Mixed**	**Pork**	**Small**	**Stockless**	**Total**
Dairy	**69 (97%)**	1	1				71
Beef		**52 (90%)**	2	2	1	1	58
Mixed	5	9	**80 (73%)**	9	1	6	110
Pork		1	1	**16 (80%)**		2	20
Small		7	9	1	**13 (43%)**		30
Stockless			16	2	5	**136 (86%)**	159
Total farms	74	70	109	30	20	145	448

Table 4. Total livestock units (LU) on 448 farms converting to organic farming. 'Before conversion' is number of livestock the year prior to onset of conversion in 1997. 'After conversion' is planned livestock numbers in year 2000.

Livestock type	LU before conversion	LU planned after conversion	Change % (before = 100)
Dairy			
Large[1]	4855	5197	107
Jersey	247	337	136
Young stock	1863	1875	101
Beef cattle	2029	2027	100
Sows	404	462	114
Slaughter pigs	715	701	98
Chickens	197	63	32
Hens a.o.[2]	198	393	198
Sheep, goats	241	333	138
Total	10748	11388	106

[1]Large breed dairy cows in Denmark are predominantly the Danish Frisian breed, as distinguished from the smaller Jersey breed that plays a larger role on organic than on conventional farms.
[2]Comprises egg-laying hens (*Gallus domesticus*) as well as a small number of other large poultry (a.o.) such as ducks (*Anas platyrhynchos platyrhynchos*) and geese (*Anser* sp.).

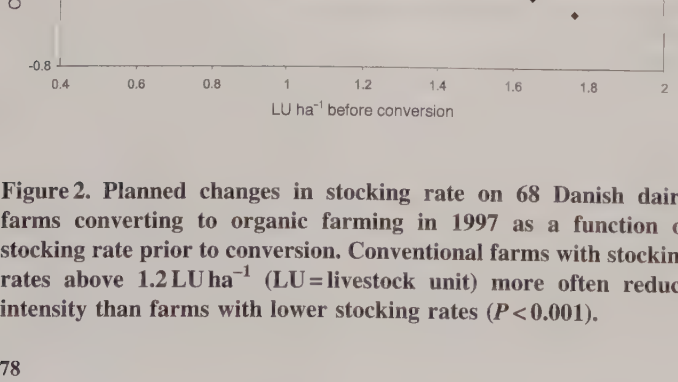

Figure 2. Planned changes in stocking rate on 68 Danish dairy farms converting to organic farming in 1997 as a function of stocking rate prior to conversion. Conventional farms with stocking rates above 1.2 LU ha^{-1} (LU = livestock unit) more often reduce intensity than farms with lower stocking rates ($P < 0.001$).

Table 5. Changes in mean stocking rate with conversion to organic farming on different farm types. Mean stocking rates are average of farm rate, i.e., not weighted for farm size.

Farm type	Mean stocking rate		Number of farms
	Before conversion	After conversion	
Dairy	1.14	1.16	74
Beef	0.79	0.96	70
Pigs	0.83	1.28	30
Mixed	0.59	0.9	109
Small	0.23	0.25	20
Stockless	0.03	0.01	145

maintain it at about 0.80 LU ha^{-1}. Both mixed and pig farms plan to increase overall stocking rates. It is noteworthy that as the average farm livestock rates are calculated, the same numerical increase in number of animals results in a much larger increase in stocking rates on small than on large farms. For example, the sizeable increase from an average 0.83 to 1.29 LU ha^{-1} on pig farms is mainly due to planned increases on small farms in north Jutland, whereas larger farms in south Jutland and on the islands show more moderate increases.

Changes in crop distribution. Farmers plan to change crop distribution substantially with conversion. Overall changes on all 448 farms (Table 6) show a 20% decrease in cereal hectarage mainly due to a large decrease in winter cereals, that is only partially compensated for by an increase in spring cereals. The hectarage with grassland in rotation, primarily clover/grass ley (i.e., pastures), is planned to double to more than a third of the area for all farm types, whereas the hectarage of set-aside, row crops and oilseed rape (*Brassica* sp.) decrease, and roughage and seeds remain unchanged. However, changes in crop distribution are strongly linked to farm type (Table 7). Changes on dairy farms most closely resemble the overall changes, as this farm type comprises most of the hectarage. On dairy farms, leys are planned to increase from one-quarter to almost one-half of the production area. Since spring cereals, silage cereals and permanent grass remain at the same level, the large increase in ley occurs at the expense of winter cereals, row crops, oilseed

rape, pea (*Pisum sativum* L.) and seeds, which all practically disappear.

On farms without stock, the hectarage with ley is planned to increase substantially to 25% at the expense of winter cereals, which decline from 40 to 19% with conversion. The same change occurs with mixed livestock and meat-producing farms, where ley is planned for one-third of the area following conversion with at the expense of a 50% reduction in winter cereals.

A number of specific crops are greatly reduced with conversion. Fodder and sugar beet (*Beta vulgaris* L.) were grown on 33 farms, mainly dairy, before conversion, but only nine of these plan to grow fodder beets after conversion. Before conversion, oilseed rape was grown on 67 farms for a total of 527 ha, but after conversion only four farms plan to grow oilseed rape on a total of 14 ha. Also, seed production is perceived as difficult, and only 1 of the 10 farmers growing seeds before conversion plans to continue production after conversion, whereas nine 'new' farmers, i.e., non-seed producers before conversion, plan to produce seeds after conversion.

Farm size. Because the available data do not reveal whether farmers plan to adjust farm size, e.g., by leasing more land as a consequence of conversion to organic farming, farm size is assumed to be unchanged by conversion.

Table 6. Overall crop distribution on 448 farms converting to organic farming in 1997 before and after conversion.

Crop group[1]	Area before conversion (%)	Area after conversion (%)
Winter cereals	23	9
Spring cereals	23	28
Set-aside	8	3
Ley	18	36
Row crops	3	1
Other spring: oilseed rape[2], pea[3]	4	3
Other winter: oilseed rape	2	0
Seed	1	1
Permanent grassland	12	12
Roughage	6	7
Total	100	100

[1]Spring and winter cereals are to maturity. Roughage is cereals and maize for silage. Row crops are mainly fodder beets (*Beta vulgaris* L. ssp. *vulgaris alba* DC.), potatoes (*Solanum tuberosum*) and vegetables. Ley is clover/grass, alfalfa (*Medicago sativa*) and grass in rotation. Set-aside is non-permanent set-aside. Permanent grassland also includes permanent set-aside.
[2]*Brassica napus* L. var. *napus*.
[3]Pisum sativum.

Discussion

The more specialized and intensive conventional agriculture is in an area, the greater is the change required to 're-introduce diversity and scale down the intensity of individual enterprises' that are desired in organic agriculture (Lampkin, 1998). Whether changes towards greater on-farm diversity and lower production intensity actually take place on farms following conversion to organic farming is especially relevant for countries or regions with an agricultural structure similar to Denmark's, i.e., where a very high proportion (54%) of the agricultural land is in rotation, where permanent grassland with a high nature conservation potential is sparse, where intensive and specialized conventional farms dominate, and where problems associated with the impact of agriculture on the environment and nature are well documented and a subject of public interest. In such areas the potential for benefits resulting from farms converting to organic agriculture is expected to be large.

Table 7. Changes in crop distribution (% of production area) on 448 farms converting to organic agriculture in 1997.

	Farm type											
	Dairy		Stockless		Mixed		Beef		Pork		Small	
Crop group	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Winter cereals	12	2	40	19	33	14	16	8	36	23	16	12
Spring cereals	23	24	21	31	23	31	23	25	23	30	56	30
Set-aside	6	3	11	4	9	5	5	2	5	3	1	1
Ley	27	48	9	25	13	32	23	34	13	19	11	36
Row crops	5	1	3	3	2	1	2	1	<1	4	3	4
Spring oilseed rape[1], pea[2]	3	<1	5	5	6	4	6	3	8	6	4	4
Winter oilseed rape	1	0	4	<1	1	0	3	<1	6	0	0	0
Seed	1	0	1	2	3	1	0	0	<1	2	0	0
Permanent grassland	10	11	5	6	7	7	21	19	6	8	9	10
Roughage	12	11	1	5	3	5	1	8	2	5	0	3

[1]*Brassica napus*.
[2]*Pisum sativum*.

Changes in farm types

The 448 farms converting to organic agriculture in 1997 are representative of the pattern of conversion observed throughout the 1990s in Denmark, in that dairy farms dominated because of the favorable market for organic milk. During this period, farms without stock and pig farms accounted for only a minor part of the converted farms, despite state subsidies aimed specifically at encouraging these farms to convert to organic agriculture. Since 1999, the Danish market for organic milk has become less favorable, and although this farm type still strongly dominates certified organic farms, the proportion of dairy farms among the new converters has diminished.

Most farmers converting to organic farming in 1997 do not plan any substantial changes in the farm enterprise as a result of conversion, but plan to continue their original production system, in which they have the expertise and facilities. The fact that most of the organic milk and vegetables are distributed and marketed by cooperatives that also market conventional milk and vegetables probably plays a major role in this lack of transfer between production types. As a consequence, the regional distribution in farm types of conventional farms is largely maintained after conversion. It should be kept in mind that the data here offer information about farmers' short-term plans, and that the plan submitted by the farmer in the application is the 'safe version', i.e., a statement of minimal changes to be implemented from conversion.

Specialization and livestock intensity

The growth in livestock production intensity, as measured by total number of livestock units found on all converting farms, indicates that livestock intensity does not automatically decrease when farms convert to organic farming, mainly because most of the converting farms already have relatively low livestock intensities. Conventional dairy farms with low initial stocking rates are usually interested in the possibility of expanding milk production when converting, and dairy farms with higher initial stocking rates often view conversion as an opportunity to establish a new balance between farm area and livestock enterprises. In many cases this adjustment involves maintaining the number of dairy cows and decreasing the livestock units in meat cattle or pigs, leading to a reduction in production diversity. This specialization trend occurs mainly on large dairy farms and is partially compensated for by diversification in livestock production on a number of small farms that expand their operation from only cattle to both pigs and cattle. It is important to note that the increase in total number of livestock units following conversion for the farms as a group does not bring the converted farms close to the average livestock intensity of conventional farms.

Crop diversity

On most organic farms a rotation of various crops (root, leaf, grain), with different management regimes and a wide genetic diversity is considered desirable (Lampkin, 1998). On the farms considered here, crop distribution changes with conversion depend on adequate fodder production for livestock productio and for sufficient nitrogen fixation on farms without stock. T meet these needs, rotations with 25–50% in leys of clover/gra or other legumes are needed after conversion, but often can b accomplished only at the expense of cash crops such as wint wheat (*Triticum aestivum* L.) and oilseed rape. In addition, number of crops may create a range of problems in organ farming systems, for example oilseed rape may enhance wee problems in the following crops, sugar or fodder beets ma require hand hoeing, and winter barley may increase diseas problems. The need for large ley areas combined with th exclusion of certain crops could limit diversification of crop with conversion. Thus, organic dairy farms may exhibit limite rotations if crop diversity is viewed solely as number of differe crop types.

Conversely, favoring diversification is the adoption of ne crops with conversion, e.g., mixtures of barley (*Hordeu vulgare* L.) and pea that are rarely grown on convention farms without stock. Also the sizeable proportion of undersow cereals, which is a result of the large hectarage of ley represents crops that are fundamentally different from cerea not undersown, because soils are undisturbed for sever seasons. Furthermore, on a landscape scale, clover/grass ley which form a 'new crop' on farms without stock, as well a outdoor-managed sows, which can be viewed as a 'new crop' o pig farms, add to the diversity of the cropping mix in area dominated by stockless and pig farms, normally dominated b annual cereal crops. Finally, the use of annual legumes f nitrogen fixation instead of as 2- and 3-year leys, and new crop adopted with the specific purpose of feeding pigs and poultr have the potential for increasing crop diversity.

Thus, the evaluation of whether crop diversity increases wi conversion must take into account both the farm type in questio and the scale. Local landscapes dominated by dairy farms ma increase in grassland cover with conversion and thus be seen a more monotonous, whereas conversion may contribute greatly local crop diversity in areas dominated by stockless farms, eve if the number of crops on converting farms does not change.

Conclusions

This study attempted to answer the following questions whe conventional farms are converted to organic farms: do organ farms become less specialized and less intensive, and do they, a group, contribute to a more uniform regional distribution farm types? Judging from the farms examined, these questio cannot be answered with a simple 'yes'.

The modest changes in livestock intensity are due to the fa that the conventional farms were mainly farms with harmon between livestock and land. Only a few livestock-intensi farms, where dramatic changes are necessary to impleme organic practices and satisfy production requirements, are fou in the group of converting farms. Thus, the converting farms 1997 did not become less livestock intensive with conversio but were already less livestock intensive than the avera conventional farms before conversion.

Farmers who decided to convert to organic farming in the late 1990s were driven by agronomic challenges, environmental concerns and economic benefits, rather than by the will to represent an alternative to conventional agriculture (personal communication by Egon Noe, scientist, Department of Agricultural Systems, Danish Institute of Agricultural Sciences (DIAS), Research Center Foulum, PO Box 50, 8830 Tjele, Denmark, January 2001). Assisted by the well-established marketing system for organic milk, grain products and vegetables, it is not surprising that most farmers plan at least in the short run to continue with the same production type and not make dramatic changes in the farm enterprise. This also implies that a general increase in the diversity of commercial livestock production following conversion did not occur. However, the diversification in livestock production that occurred on many smaller farms indicates that an expectation of large on-farm diversity in crop and livestock production may be better satisfied on small than on larger organic farms.

The results emphasize that changes following conversion to organic farming must be viewed both on the individual farm and on landscape and regional scales. On the one hand, the basic concept of the organic farm as a self-supporting entity (Vereijken and Baars, 1995) puts focus on within-farm versatility of crops and livestock activities. On the other hand, it is also evident that effects on more aggregated scales need to be considered (Baudry et al., 1997), e.g., that crop diversification in uniform agricultural landscapes may be achieved independent of whether individual farms become more diverse with conversion to organic agriculture.

Scale of diversity is also important when discussing the adverse effects of regional concentration of farm types. If organic farms are largely self-contained with a high level of crop and livestock diversity, the concept of a strong regional concentration of certain types of organic farms is irrelevant. Only when organic farms are not self-sufficient and depend on adjacent farms of different types for manure or fodder, can concentration impair the expansion of organic agriculture.

Viewing the individual farm, including the farmer, as an entity, has been beyond dispute when dealing with organic farms lying like isolated islands in a sea of conventional agriculture, but this needs to be re-evaluated when organic farms become more widespread and organic farmers cooperate and interact with their organic neighbors (Raupp, 2000). Therefore, future discussions of the desired development in diversity and intensity of production on organic farms should include not only the farm scale, but also cooperating and neighboring farms and the local scale.

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A History of Farming Systems Research

Edited by **M Collinson**, *former Social Science Adviser in the Secretariat of the CGIAR, Washington DC, USA*

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Readership: Agricultural economics and development studies.

Farming Systems Research (FSR) may be defined as a diagnostic process, providing a collection of methods for researchers to understand farm households and their decision-making. Its applications use this understanding to increase efficiency in the use of human and budgetary resources for agricultural development, including research, extension and policy formulation.

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The economics of organic milk production in California: A comparison with conventional costs

Leslie J. Butler

Abstract. *Interest in organic dairying is increasing at a rapid pace in California, and the demand for organic milk and dairy products is growing even faster. The intent of this study was to determine the cost of organic milk production, and in particular, to determine the differences in cost of production of organic and conventional milk. Primarily we are interested in whether the differences are due to government-mandated requirements or whether they are the result of optional procedures or personal preferences. Previous studies have indicated that under organic production, the higher net returns observed on organic farming enterprises are due mainly to the lower cost of production. This conclusion is not sustained here. Our results show that the total cost of production on a per cow and a per hundredweight basis is 10–20% higher for organic producers than for conventional producers. While not strongly statistically significant, the differences appear to be due to higher feed costs, higher average labor costs, significantly higher herd replacement costs, and significant transition costs*

Key words: organic dairying, organic farming, organic milk, organic production costs, transition costs

Organic Dairying in the US

According to the US Department of Agriculture (USDA), organic farming was one of the fastest growing segments of US agriculture during the 1990s, and producers, exporters, and retailers are struggling to meet consumer demand for a wide range of organic products (Greene, 2000). The number of organic farmers is increasing by 12% per year, and farm sales of organic produce have grown from $78 million in 1980 to about $6 billion today, with projected growth of 20% a year. According to USDA–ERS studies, two organic livestock sectors—eggs and dairy—grew even faster (Greene, 2000). During the period 1992–97, the number of registered organic dairy cows (*Bos taurus*) in the US increased sharply, from 2265 in 1992 to 12,897 in 1997. Preliminary estimates for 1999 put organic cow numbers near 20,000. In 1997, dairy cows were managed organically in 13 states. New York was the leading state with 3386 dairy cows, followed by Wisconsin with 2509, and Minnesota with 2425 dairy cows. Pennsylvania, California, and Maine also had over 1000 organic dairy cows each. In 1999, Idaho became a major organic dairy state with over 3000 cows.

Organic farming systems rely on ecologically based practices, such as cultural and biological pest management, and virtually exclude the use of synthetic chemicals in crop production and prohibit the use of antibiotics and hormones in livestock production. Organic livestock production systems attempt to accommodate an animal's natural nutritional and behavioral requirements. Livestock standards address the origin of each animal and incorporate requirements for living conditions, access to the outdoors, feed ration, and healthcare practices suitable to the needs of particular species. For example, dairy cows must be organically managed for a year prior to producing certified organic milk, must receive only 100% organic feed and allowed supplements, must have seasonal access to pasture, and cannot be treated with antibiotics.

Certified organic dairy products have been allowed to carry an organic label throughout the 1990s. Organic dairy sales in mainstream supermarkets were up 200% or more between December 1997 and December 1998 in Baltimore, Phoenix, Detroit, Boston, and other major markets, according to USDA (Greene, 2000). According to one source, organic milk accounts for 1.2% of the market in Boston, more than 3% in Denver, and over 2.5% of the market in Los Angeles (personal communication by M. Retzloff, Horizon Organic, Boulder, Colorado, October 2000).

US governmental efforts to facilitate organic production have focused primarily on developing national certification standards to consumers, ensuring that these commodities meet a consistent standard and to streamline interstate commerce in organically grown agricultural products. In 1990, the US Congress passed the Organic Foods Production Act as a part of the 1990 Farm Bill, to establish national standards for organically produced commodities, and created the National Organic Standards Board (established by the Act 6518) to usher the new law into effect. In 1997, the USDA proposed a new set of organic standards that suggested that some irradiated and genetically engineered foods could be included in the organic category. However, more than 280,000 protest responses from consumers and the organic industry prompted the USDA to reconsider the new standards.

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The revised proposed rules, released on 7 March 2000, excludes both irradiated foods and genetically engineered products and, for dairy, prohibits the use of recombinant bovine somatotropin (rBST) by organic producers and requires zero tolerance antibiotic residues in organic milk. The new proposed rules also make it more difficult for established dairy producers to get into the profitable niche market of organic milk products. To be approved under USDA's organic standards, as proposed, milk must be 100% under continuous organic management for 1 year prior to delivery. Cows producing organic milk must be fed 100% organic feed, and there is zero tolerance for antibiotics. Parasiticides also cannot be used on a regular basis and require 90-day withdrawal times. Genetically modified organisms (GMO) or their derivatives are not allowed, including chymosin (used in cheese making) and rBST. In addition, cows must have access to pasture during the growing season.

While the pace of development of organic agriculture has increased dramatically in the US in the past decade, European countries have converted a much higher amount of farmland to organic management, aided by direct financial support provided for conversion to organic farming since the late 1980s (Lohr and Salomonsson, 2000). However, several states in the US have begun providing financial support for conversion to organic farming systems as a way to capture environmental benefits of these systems. In Iowa, organic crop production has been an approved state conservation practice since 1997, and is eligible for cost-share support from USDA's Environmental Quality Incentive Program (Greene, 2000). In Minnesota, the Department of Agriculture implemented an Organic Cost Share Program in 1999, which is designed to explicitly reimburse Minnesota producers for up to two-thirds of the cost for organic inspection and certification (Greene, 2000). Also, several state-run certification programs (such as the one in California, for example) charge nominal or very low fees to encourage organic production.

A recent crop insurance bill passed in the spring of 2000 [HR 2559, Agricultural Risk Protection Act of 2000, Section 524 Education and Risk Management Assistance, (b)(2)(C)(iii)] authorizes $10 million for, among other resource conservation practices, transition to organic farming. The Act provides this funding beginning in the 2001 fiscal year and 'each subsequent fiscal year'. When implemented, this funding will be available in not less than 10, and not more than 15 states, which have historically received low Federal crop insurance payments. Funding will also be limited to $50,000 per recipient. Which department at USDA will administer this funding is still in discussion, but the Agricultural Marketing Service (AMS) is likely to have some authority (personal communication, Diane Goodman, private consultant, San Francisco, CA, December 2000).

Organic Dairying in California

Organic standards in most states are much stricter than the rules issued under the OFPA. In California, organic milk production must conform to the California Organic Foods Act of 1990, with regulations found in the California Food and Agricultural Code and Health and Safety Code, that stipulate among other things, that:

- Under the original Act, all feeds administered to livestock within 1 year of the taking of milk must be 100% certified organic. This was amended in 1998 to stipulate that in the first 10 months prior to the taking of milk, 80% of any feed must be organic, and in the final two months, 100% must be organic. This regulation will remain in effect until the implementation of the Federal program.
- The use of any drug, medication, hormone or growth regulator—synthetic or otherwise—and any synthetic substance including growth or milk stimulants and antibiotics, is prohibited. (The exception is that if a licensed veterinarian prescribes a drug or medication for a sick cow, the withdrawal period is 30 days or twice the US Food and Drug Administration specified time, whichever is the longer.)
- Artificial rumen stimulants, such as plastic pellets and any fed or refed manure are also prohibited.
- All organic milk producers must be registered with the California Organic Program, administered by the California Department of Food and Agriculture (CDFA). When the Federal program is enacted, certification by a USDA-accredited certifying agency will be mandatory.
- All feeds grown for the purposes of feeding cows in the production of organic milk (including pastures) must also meet all the stringent criteria stipulated by the California Food and Agricultural Code for organic production.

There are about ten organic dairy producers in California each with an average of about 200 cows producing organic milk. Average production per cow varies considerably among organic producers, but appears to average about 8200 kg (18,000 lb). Thus, total production of organic milk in California in 1999 was about 16.4 million kg (36 million lb), which was approximately 0.12% of the total milk produced in California—a very small amount. However, about 90% of the organic milk produced is used for Class 1, or fluid, purposes. Thus, organic milk constitutes about 0.5% of the total fluid milk market in California.

Study Objectives

The main goal of this study was to determine the cost of organic milk production and, in particular, to determine the differences in cost of production between organic and conventional milk. Primarily, we were interested in whether the differences in cost are due to government-mandated requirements, or whether they are the result of optional procedures or personal preferences.

Previous studies have indicated that, under organic production, elimination of chemical inputs typically decreases yield by 7–9% (depending on the crop), increases labor requirements, reduces production costs, inconsistently affects net returns, and substantially increases energy efficiency (Stonehouse et al. 1996). The higher net returns observed on organic farms were generally due to lower production costs, and in some instances to output price premiums.

Ogini et al. (1999) compared the scale of operation and economic performance of eight organic dairy operations (comprising 40% of all organic dairy farms) with 120 conventional dairying operations (1.5% of provincial total) in Ontario in 1992. It was hypothesized that both total revenue and cost of production would be greater on conventional farms, while net farm income would be higher on organic farms. Although the ratio of organic to conventional performance was 93% for revenue and 77% for cost of production, neither of these differences was statistically significant. However, organic dairies yielded a statistically significant 60% more net farm income than conventional dairies.

For most dairy producers, converting from conventional to organic production is a long-term commitment that needs to be carefully planned and executed to avoid the financial stress that can occur during the transition period. This is particularly true in California, where dairying is characterized by large herds, dry-lot intensive feeding of mainly purchased feeds, and the use of alternative feeds. The fact that California dairy producers rely mostly on purchased feeds and grow very little of their own (apart from pasture), means that organic dairy producers must find sources of organic feed that satisfy the stipulated standards. These feeds often cost 25–50% more than conventional feeds.

In addition, since organic milk producers are prohibited from using drugs, medication, and growth stimulants or regulators, the problem of dealing with sick or ailing cows is much more complicated than it is for the conventional dairy producer. Organic producers have several ways of dealing with this problem. First, some natural medications such as aspirin, garlic (*Allium sativum*), and echinacea [an herbal remedy prepared from the pulverized leaves and stems of purple coneflowers (*Echinacea rudbeckia ratibida*)], are often used to combat common cow ailments. Secondly, since the most effective way to treat diseases is through a preventive approach, organic producers often scale back milk production to reduce stress, unlike conventional producers whose aim is to maximize milk production. As one producer stated, 'Cows are like cars, if you push them too hard, they break'. This often leads to a reduction in milk production of 10–20%. Thirdly, organic producers often attempt to provide a favorable environment to maximize cow comfort as a way to reduce the potential for sub-clinical mastitis and similar diseases. However, this may lead to slightly higher operating costs.

Since cows entering an organic dairy herd must be fed organic feeds at least 1 year prior to the taking of milk, most organic producers find it necessary to raise their own replacements organically, or to purchase specially raised organic cows. This often adds an additional 10–20% to the cost of replacement.

A significant cost for most organic producers is in the conversion from conventional to organic dairying. During this 1-year period the produce can only be sold as conventional milk. The costs associated with this transition can only be recovered after the dairy has been certified organic.

Organic dairy producers are usually certified by an accredited certifying agency. In California, the cost of certifying an organic dairy herd ranges from $2000 to $3500. In addition, pastures are also certified as organic. Some counties also require organic producers to pay an additional 'organic' tax. Thus, costs associated with marketing organic milk also have some additional costs over conventional dairying.

Assuming feed costs are about 50% of total costs, herd replacement about 15%, and operating costs about 12%, these additional costs would add about 15–20% to the total costs of an organic dairy over a conventional operation.

The hypotheses to be tested are:

1. Feed costs will be greater on organic dairies than on conventional farms. As mentioned previously, other studies of organic dairy production have found that in most circumstances, the total cost of organic milk production is lower than conventional production, due to reduced purchases of drugs, dairy herd replacements, feed, seed, organic fertilizers, and pesticides (Stonehouse et al., 1996). In contrast, preliminary findings of organic milk production in California, and other states where purchased feed is the norm, show that feed costs for organic milk production are much higher than for conventional dairying.
2. Total costs of production will be greater on organic dairies than on conventional dairies. In addition to higher feed costs, organic dairy producers often both scale back milk production and attempt to maintain higher standards of cow comfort so that the potential for diseases is reduced. In addition, most organic producers find it necessary to raise their own replacements organically, or to purchase specially raised organic cows. This may lead to higher operating costs.
3. Net farm income will be higher on organic dairies than on conventional dairy farms. Although we hypothesize that the cost of producing organic milk will be higher than the cost of producing conventional milk, most organic milk producers have a fixed price contract to produce organic milk that pays considerably higher prices than the prices paid to conventional milk producers. The fixed price contract achieves two things. First, the price is usually set high enough to ensure that producers are well compensated for converting to organic production. Secondly, it takes a significant amount of price risk away from the dairy operation, thus ensuring a steady supply of organic milk for the market.

Methodology

We identified six organic milk producers who were willing to share their cost of production data for 1999 for this study. Of these, three were in the North Bay region of California, located north of San Francisco, in the counties of Marin, Sonoma, and Mendocino. The other three were located in the central area of the North Valley region, which includes all the interior counties in northern and central California from Shasta to Madera.

As Ogini et al. (1999) indicate, a major challenge of this type of research is finding comparable data from both organic and conventional producers. Fortunately, the CDFA conducted a comprehensive survey of dairy enterprises in the state. Under the California Food and Agricultural Code 62062, the CDFA must consider the cost of producing market milk in determining

appropriate minimum prices for various classes of milk. The cost of producing milk was actually included in the Class 1 formula for milk into the early 1990s. The CDFA also uses the cost of production studies for a number of other functions, including end product pricing formulas, hearings on milk pricing, and for outreach purposes. The CDFA publishes the cost of production data in a number of forms, including bimonthly milk production cost index reports, feedback reports, and an annual summary of the average cost of milk production in California.

The CDFA cost of production survey consists of about 400 dairy enterprises in the five major producing regions of California. Each dairy is visited every 2 months, and the data are summarized in the form of costs per cow per month, or costs per cwt of milk produced per month (a cwt, or one hundredweight, is a weight measure of 100 lb or 45.45 kg, and is widely used in the US commercial dairy industry). In this study, we made use of the feedback reports, which consist of bimonthly observations of the monthly costs associated with producing milk on each dairy in the survey. Since the organic farms were located in only two of the five regions, we used the feedback reports from those two regions (North Bay and North Valley), and specifically only used the data pertaining to the comparable herd sizes in each region. Thus, our comparative data set includes seven dairies from the North Bay region, and 20 from the North Valley region, for a total of 27 conventional dairy enterprises. Since we could not identify, for confidentiality purposes, the bimonthly observations for each dairy enterprise, the data from the two regions were combined, annualized and summarized in monthly format. All data are for the year 1999.

In summary, we are comparing 6 organic dairy enterprises with 27 conventional dairy enterprises from the same production regions and of comparable herd size for the year 1999. As with other studies of this nature, the small sample size of organic dairies increases the influence of individual operator variability, a factor that is more effectively obscured in the larger conventional dairy sample.

The survey of organic dairies followed the format of the CDFA survey as closely as possible, to make them as comparable as possible. However, there are differences in the way the surveys were conducted. First, the CDFA survey is conducted bimonthly for each dairy, and the data are reported as monthly costs. In contrast, the survey of organic dairies was carried out only once. Where possible, monthly costs and production statistics were recorded, but some data were only available on an annual basis, and converted to monthly data for comparative purposes. Secondly, we were not able to identify each individual farm included in the CDFA survey, for confidentiality purposes. Therefore the CDFA data do not allow us to annualize each individual farm and perform detailed statistical comparisons between conventional and organic farms. Thirdly, certain data collected and reported by the CDFA differed from the data collected from organic enterprises because CDFA use a number of averaging factors to harmonize their data. For example, labor wage costs collected by the CDFA use an average hourly rate for all hired employees in the cost of production area. Interest expenses include a standardized feed inventory and are calculated using an average current rate paid on agricultural loans. Taxes and insurance expenses on owned real and personal property used in the dairy operation are assumed to be the same for all enterprises in a production region. Blend prices received for milk are based on the California Pool Price announcement for the month, and do not include quality or yield bonuses.

Hypothesis Testing

Since data from only six organic dairy farms out of a total population of about ten were compared with those from with 27 conventional dairy farms, we need to engage in a little 'small sampling' theory. In most statistical decision theory, it is assumed that sample sizes are 'large' (i.e., $N > 30$), and the relevant sampling distributions are approximately normal, with the approximation improving with increasing N. For samples of $N < 30$, called 'small samples', this approximation is not accurate, and becomes less accurate with decreasing N. Therefore, appropriate modifications need to be made.

In small sample theory, we make use of 'Students' t-test which is analogous to the z statistic for a standardized normal distribution, but is adjusted such that the sample variance accounts for a number of population parameters (degrees of freedom). As the sample size, N, increases to approximately 30, the t distribution gets closer to the standardized normal, or z distribution. Tests of hypotheses and significance are easily extended to problems involving small samples, the only difference being that the z statistic is replaced by a suitable t statistic. When $N < 30$, the following t distribution approximates the z distribution:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sigma\sqrt{1/N_1 + 1/N_2}} \quad \text{where } \sigma = \sqrt{\frac{N_1 S_1^2 + N_2 S_2^2}{N_1 + N_2 - 2}}$$

and where:

$\overline{X}_1$ and $\overline{X}_2$ = sample means of respective populations
N_1 and N_2 = sample size of the respective populations
S_1 and S_2 = standard deviations of the respective populations.

In this case we will be examining the differences between the means and variances of two samples, one sample being organic dairies (μ_1) and the other being conventional dairies (μ_2). Therefore, our null hypotheses, H_0, will be that the resulting means are equal to each other ($\mu_1 = \mu_2$) and that the difference between them is due to chance. Our alternative hypotheses, H_1, will be that $\mu_1 > \mu_2$ and that the treatment causes this difference (in this case, our 'treatment' is organic dairying).

1999 Survey Results and Comparative Analysis

Feed costs

Tables 1 and 2 show comparative data on basic statistics and feed costs on a per cow and per cwt basis. The average prices o

hay [in this case alfalfa (*Medicago sativa* L.)] and concentrates presented in Table 1 show that organic producers must pay significantly higher prices for these items than conventional producers.

However, the higher prices paid for organic feed do not necessarily translate into significantly higher feed costs, although they clearly have an influence. Total feed costs for organic producers are only 5–6% higher than for conventional milk producers, and are not statistically significant, despite the fact that the prices of organic hay and organic concentrates are significantly higher than those of conventional feeds, as shown in Table 1. The only statistically significant difference between organic and conventional feed costs occurs with pasture. Thus, we cannot reject the null hypothesis (H_0) that average feed costs per cow or per cwt (Table 2) are equal. Therefore, we must conclude that there is little difference between the total feed costs associated with organic and conventional milk production.

There are several reasons for this lack of significant differences between feed costs for organic and conventional dairying. First, while organic hay and concentrate prices are much higher, it is clear that organic producers in this survey rely much more on pasture than on purchased feeds. This would account for the statistically significant differences in the costs of pasture (Table 2). Secondly, organic producers also appear to feed significantly smaller amounts of concentrates than do conventional producers (Table 1), obviously preferring to rely more heavily on pasture.

There are also some interesting regional differences in the use of pasture that are not reported in the results but are worth discussing. We found a significant difference between the feed costs in the North Bay area compared with those in the North Valley. Irrigated pastures in the North Valley allow organic producers to graze cows for 8–9 months of the year, compared to the North Bay where non-irrigated pastures last for only about 4 months.

The use of pasture is also a significant issue for the National Organic Standards Board. The proposed rules state 'cows must have access to pasture'. However, many organic producers complain that this rule may be subject to misinterpretation and abuse. For example, does 'access to pasture' mean that your 1500 organic cows should have access to your 4 ha (10 acres) of pasture for about 4 hours per month? On the other hand, how do you stipulate rules when so many variables dictate regional differences in the ability to have access to pasture?

Table 1. Basic operation data for conventional and organic dairy farms in California, 1999.

	Conventional	Organic	Ratio (O/C)
Average annual cull rate (%)	29	25	0.86
Milk cow hay price ($/ton)[2]	135.20	147.50	1.09*[1]
Price of concentrates ($/ton)	156.94	210.07	1.34***
Concentrates fed (lb/cow/day)[3]	25.05	16.24	0.65***
Milk sold (lb/cow/day)[3]	61.66	53.78	0.87*

[1] One-tailed *t*-test significance: * = 10% level, ** = 5% level, *** = 1% level.
[2] ton = 907.18 kg.
[3] lb = 0.454 kg.

Table 2. Feed costs in dollars and their ratio for conventional and organic dairy farms in California, 1999.

	Conventional	Organic	Ratio (O/C)
Per cow per month			
Dry roughage	31.29	35.44	1.13
Wet roughage	14.30	14.07	0.98
Concentrates	51.55	48.70	0.94
Pasture	2.10	6.66	3.17*[1]
Total	99.25	104.87	1.06
Per cwt of milk[2]			
Dry roughage	1.98	2.24	1.13
Wet roughage	0.89	0.80	0.89
Concentrates	3.24	3.09	0.95
Pasture	0.14	0.45	3.18*
Total	6.25	6.57	1.05

[1] One-tailed *t*-test significance: * = 10% level, ** = 5% level, *** = 1% level.
[2] cwt = 100 lb or 45.45 kg.

Table 3. Cost of production in dollars and the ratio for conventional and organic farms in California, 1999.

	Conventional	Organic	Ratio (O/C)
Per cow per month			
Feed	99.25	104.87	1.06
Labor	27.66	31.05	1.12
Herd replacement	22.94	28.41	1.24*[1]
Operating	32.39	32.79	1.01
Interest expenses	20.30	11.57	0.57**
Depreciation	6.53	10.95	1.68***
Taxes and insurance	1.40	3.60	2.58***
Less miscellaneous income	–3.72	–3.27	0.88
Transition	0.00	5.34	
Total	206.74	225.32	1.09
Per cwt of milk[2]			
Feed	6.25	6.57	1.05
Labor	1.78	1.95	1.10
Herd replacement	1.44	1.87	1.30**
Operating	2.05	2.14	1.04
Interest expenses	1.29	0.75	0.58**
Depreciation	0.41	0.68	1.65***
Taxes and insurance	0.09	0.24	2.66***
Less miscellaneous income	–0.24	–0.21	0.91
Transition	0.00	0.20	
Total	13.07	14.19	1.09*

[1] One-tailed *t*-test significance: * = 10% level, ** = 5% level, *** = 1% level.
[2] cwt = 100 lb or 45.45 kg.

Cost of production

The survey results indicate that the cost of organic milk production is about 10% higher than conventional milk production, although this difference is not statistically significant on a per cow basis, and is significant only at the 10% level on a per cwt basis (Table 3).

As mentioned previously, labor costs are expected to be slightly higher with organic than conventional operations because of increased labor requirements. For example, one major source of increased labor costs with organic dairying is from controlling weeds in pastures by hand because organic producers are prohibited from using herbicides in their fields. However, labor costs for organic dairies in our survey are rather disparate among the survey participants. About half of the participants had higher than normal labor costs, simply because they paid higher wages. The other half, which consisted primarily of small, family-run enterprises, had lower than normal costs because they did not engage much additional labor. These costs would be higher if the opportunity costs of unpaid family labor were included.

As originally hypothesized, herd replacement costs are significantly higher for organic producers because replacement heifers must be raised organically, or must be purchased from specialized organic heifer breeders. Most organic producers paid 15–20% more for organically raised heifers compared with the prices for conventionally raised animals, although the survey results show that replacement costs increase by about 24% on a per animal basis and 30% on a per cwt basis. However, these increased costs may be offset somewhat by the fact that organic producers have a lower rate of culling and replacement than do conventional producers and, thus, organic cows remain in the herd longer. Table 1 shows that organic culling rates trend lower than conventional rates, although the difference is not statistically significant.

Despite the fact that some operating costs for organic operations may be higher than those for the conventional, because of a focus on cow comfort among other things, some are lower. Veterinary and medicine costs, for example, are much lower on organic than conventional dairies, while other costs are similar. Overall, we conclude that total operating costs for the organic and conventional dairies are similar.

Interestingly, the results show that interest expenses for organic producers are almost half those for conventional producers, while depreciation expenses are about 60% higher. This may be an anomaly in the survey results; however, some of the difference can be explained by the way CDFA measures these costs. Interest expenses in the CDFA survey include a standardized feed inventory and are calculated using an average current rate paid on agricultural loans. However, most of the surveyed organic producers did not appear to have much debt to service, and some were well-established operators who owned their business. In neither case are the opportunity costs of equity capital taken into account. On the other hand, higher rates of depreciation among the organic producers would indicate higher rates of investment in facilities and cows, with no resulting increase in the rate of borrowing. In any case, the two expenses almost offset each other and very little can be attributed to the significance.

Taxes and insurance expenses for organic producers are mor than double those of conventional producers. This differenc may be explained by a number of factors. First, the reported ta and insurance expenses for conventional producers may be lowe because of the way they are calculated. In the CDFA feedbac reports used to calculate the costs of conventional dairying, ta and insurance expenses are reported at a constant $1.88 per cow per month for the North Bay and $1.23 per cow per month fo the North Valley, regardless of the size of the enterprise o facilities, or any of a number of other factors that influence ta and insurance expenses. By contrast, tax and insurance expense reported in the results of the organic survey are actual expenses and vary from enterprise to enterprise. Secondly, organi producers may have higher taxes because of their higher income Thirdly, organic producers may have higher insurance premium because they have more expensive cows, or because thei operation is valued higher than for conventional producers Fourthly, there may be some additional taxes associated wit establishing an organic dairy.

Miscellaneous income is the additional income derived fron the sale of drop calves and manure, and is reported as part of th costs of production in order to comply with the way in which th CDFA reports the statistics that are used here for compariso (Table 3). Note that it is subtracted from the other costs. Th table shows that miscellaneous income for organic producers i about the same as for conventional producers.

In summary, our results show that the cost of production on per cow or a per cwt basis is about 10% higher for organi producers than for conventional producers. While the difference are not strongly statistically significant, the differences appear t be due to slightly higher feed costs, slightly higher average labo costs, significantly higher herd replacement costs, and significan transition costs, discussed in the following section.

Lest the reader should feel that the increased costs are not *tha* significant, consider the following. The average organic dairy i California has 200 cows producing around 18,000 lb (8200 kg) o milk. If the difference in costs is $1.12 cwt^{-1} ($0.025 l^{-1}), the the average organic dairy would sustain 180 cwt × 20 cows = 36,000 cwt × $1.12 = $40,320 yr^{-1} more in productio costs. For most dairy producers, this is a significant number. I the producer has more cows, or higher yields, then the cos differential would be even greater. Transition costs in addition t production costs will make this cost even higher, and much mor significant.

Transition costs

Dairy producers who convert their operations from conven tional to organic must undergo a period of transition whereb they must feed and operate as fully organic, but receiv conventional prices for the milk. These costs must be take into account because they are an important aspect of the financia wellbeing of the enterprise. If it was inexpensive to convert fro conventional to organic, many more producers would probabl

attempt the change to capture the prices paid in this niche market.

Although we inquired about transition costs in our survey of organic dairies, most producers did not specifically account for these costs. Instead, they accepted the loss in income over the 1-year transition period, based on knowing that the higher prices paid during the following years would compensate for the additional costs associated with conversion. Most producers simply struggled with the additional costs using bank loans and lines of credit. For some producers, transition may not be stressful. One producer converted over a period of time by operating two herds, one conventional and one organic. When the transition to organic was complete, the conventional herd was sold. Another producer simply sold his entire conventional herd and bought an organic one.

The costs associated with converting from conventional to organic include the increased costs of feeding, and the other costs of organic dairy operation outlined above, including a lower yield of milk. In order to estimate these costs, it is assumed that each dairy incurred the same costs as an organic dairy, but received only the conventional price for their milk. The actual costs associated with this are assumed to be exactly the same as borrowing the difference in net farm income from a bank, and repaying the loan at 10% interest over a period of 6 years (most financial institutions contacted about these, specified loans ranging from 3–8 years, at interest rates ranging from 8–12%). The average cost associated with transition in 1999 is $288.25 per cow, or about $0.92 per cwt of milk. Amortized over a 6-year period at 10%, the cost is $5.34 per cow per month, or about $0.20 per cwt. These costs are therefore added into the calculations of total costs in Table 3 and for the net farm income calculations below.

Net farm income

Net farm income per month (gross revenues minus total costs of production) for organic farms was more than twice that for conventional dairies on both per cwt and per cow basis in 1999, mostly because of the prices paid for milk to organic producers (Table 4). However, this is not the case when statewide comparative costs are used (following section). In previous years, when prices paid for conventional milk were higher, these differences would not be as dramatic. On the other hand, there have also been years when prices paid for conventional milk were substantially lower than 1999 prices.

Table 4. Net farm income per month in dollars and the ratio for conventional and organic farms in California, 1999.

	Conventional	Organic	Ratio (O/C)
Average blend price per cwt[1]	14.16	18.03	1.27***[2]
Less marketing costs	0.51	1.50	2.97***
= Net price per cwt	13.65	16.53	1.21***
Times cwt of milk sold	16.06	15.27	0.95
= Net receipts per cow	219.22	252.41	1.12*
Less total cost per cow	206.74	225.32	1.09
= Net income per cow	12.48	27.09	2.34*
Divided by cwt of milk sold			
= Net income per cwt	0.77	1.77	2.47**

[1] cwt = 100 lb or 45.45 kg.

[2] One-tailed *t*-test significance: * = 10% level, ** = 5% level, *** = 1% level.

Marketing costs for organic producers are much higher because of transportation and additional costs associated with organic certification. In addition, milk yields are lower for reasons referred to previously. These two factors bring gross income (or net receipts) per cow much closer for the two groups (net receipts per cow are only 16% higher for organic producers than for conventional), emphasizing the fact that the higher prices paid to organic milk producers are justified on the basis of the organic milk supply. That is, without the current prices paid to organic producers, there is no incentive to supply organic milk to the market.

Another way to look at the significance of these differences is to consider what would happen if the average organic dairy in California with 200 cows producing around 18,000 lb (8200 kg) of milk, was paid 1999 conventional prices. The net price for conventional milk in 1999 was $13.65 cwt^{-1} (about $0.31 l^{-1}) and the cost of producing organic milk was $14.19 cwt^{-1} (about $0.32 2l^{-1}). Therefore, the producer would sustain a net loss of $0.54 cwt^{-1}, or 180 cwt × 200 cows = 36,000 cwt × $0.54 = $19,440 yr^{-1}.

Statewide comparison of costs

Even though the samples of organic farms included in the survey are concentrated in the North Bay and North Valley areas of California, there are several reasons why it may be appropriate to compare their costs with statewide costs of milk production. First, organic dairying is practiced in areas of California other than the two areas from which the survey sample was drawn. Secondly, when costs of production are used in determining appropriate minimum prices for various classes of milk (California Food and Agricultural Code 62062), the figures used are statewide average costs. Thirdly, the statewide costs of production published by the CDFA are a more consistent and accurate reflection of average costs of conventional milk production in California, for reasons stated earlier in this paper. For example, we were not able to identify each individual farm included in the CDFA survey for confidentiality purposes. Therefore our comparative data of conventional milk production costs do not reflect herd size and other factors consistent with individual farm characteristics as accurately as do the published CDFA survey data. On the other hand, it should be remembered that comparing the costs of a small number of smaller organic dairies with those of the typically larger conventional dairies found in California precludes the size and scale effects that are present. The characteristically larger dairies in California presumably capture significant economies of size that have the effect of lowering the costs of conventional milk production. Therefore we would expect the comparison between the two to be more dramatic than the previous comparison of dairies of similar size.

The comparisons of organic costs of milk production with statewide average costs of conventional milk production are presented in Table 5, and for net farm income in Table 6. The costs of organic milk production are 19% higher than conventional milk production on a per cow basis, and 23% higher on a per cwt basis. These figures are much more in accord with our original hypotheses discussed in the study objective Unfortunately, it is not possible to attribute any statistic significance to these figures because variances or standa deviations are not reported with the CDFA published dat Nevertheless, comparing the data provided in Table 5 with tho reported in Table 3, it is clear that the differences in the cost

Table 5. Cost of milk production statewide in dollars, and the difference and ratio for conventional and organic dairy farms California, 1999.[1]

	Conventional	Organic	Difference	Ratio (O/C
Per cow per month				
Feed	99.99	104.87	4.88	1.05
Labor	21.93	31.05	9.12	1.42
Herd replacement	26.05	28.41	2.36	1.09
Operating	32.80	32.79	–0.01	1.00
Interest expenses	6.98	11.57	4.59	1.66
Depreciation	4.40	10.95	6.55	2.49
Taxes and insurance	1.35	3.60	2.25	2.67
Less miscellaneous income[2]	–3.72	–3.27	0.45	0.88
Transition	0.00	5.34	5.34	
Total	189.78	225.31	35.53	1.19
Per cwt of milk[3]				
Feed	5.67	6.57	0.90	1.16
Labor	1.37	1.95	0.58	1.42
Herd replacement	1.47	1.87	0.40	1.27
Operating	1.69	2.14	0.45	1.27
Interest expenses[4]	1.16	0.75	–0.41	0.65
Depreciation	0.34	0.68	0.34	2.00
Taxes and insurance	0.08	0.24	0.16	3.00
Less miscellaneous income	–0.22	–0.21	0.01	0.95
Transition	0.00	0.20	0.20	
Total[5]	11.56	14.19	2.63	1.23

[1] Source: CDFA (2000). Conventional data per cow month are statewide average, Table 1, California Production Cost Comparison, California Cost of Milk Production: Annual Summary, 1999, CDFA. Conventional data per cwt are statewide average, Table 16, California Milk Production Cost Index, California Cost of Milk Production: Annual Summary, 1999, CDFA.
[2] Miscellaneous income taken from survey results.
[3] cwt = 100 lb or 45.45 kg.
[4] Reported as return on investment for conventional results.
[5] Excludes marketing costs reported in CDFA cost index.

Table 6. Net farm income per month in dollars, and the difference and ratio between statewide conventional and organic farms California, 1999.[1]

	Conventional	Organic	Difference	Ratio (O/C
Average blend price per cwt	13.60	18.03	4.43	1.33
Less marketing costs	0.43	1.50	1.07	3.49
= Net price	13.17	16.53	3.36	1.26
Times milk sold/cow/month	17.14	15.27	–1.87	0.89
= Net receipts	225.73	252.41	26.68	1.12
Less total costs	189.78	225.32	35.54	1.19
= Net income per cow	35.95	27.09	–8.86	0.75
Divided by milk sold/cow				
= Net income per cwt	2.10	1.77	–0.33	0.84

[1] Source: CDFA (2000). Conventional data are statewide average, Table 1, California Production Cost Comparison, California Cost of Milk Production: Annual Summary, 1999, CDFA.
[2] cwt = 100 lb or 45.45 kg.

production between organic and conventional milk are of reasonably similar magnitude. Labor costs, interest expenses, and depreciation costs for statewide conventional milk production are lower than those estimated from the regional feedback reports, while herd replacement costs and operating costs on a per cow basis are higher.

A comparison of net farm income between organic and conventional dairies using statewide average costs shows that, despite the higher prices paid for organic milk, average net farm income is lower for organic than for conventional milk (Table 6). Net farm income for organic production on a per cow basis is only 75% that of conventional milk production, and only 84% on a net income per cwt basis.

Comparing statewide conventional costs of milk production with the costs of organic milk production, we can conclude:

- Feed costs for organic production are 5% higher than for conventional milk on a per cow and 16% higher on a per cwt basis.
- Labor costs for organic producers are 42% higher than for the average conventional producer both on a per cow, and per cwt basis.
- Herd replacement costs for an organic producer are 9% higher than for the average conventional producer on a per cow basis, and 27% higher on a per cwt basis.
- Operating costs are about the same for both organic and conventional producers.
- Interest expenses, depreciation and tax and insurance costs are all higher for the organic producer than for conventional milk producers.
- These all result in total costs of milk production being about 20% higher for organic production than for conventional production.
- This, in turn, results in net income per cow for organic producers of only 75% of that for conventional producers, and net income per cwt of 84%.

Conclusions

The intent of this study was to determine the cost of organic milk production and, in particular, to determine the differences in cost of production for organic and conventional milk. Previous studies have indicated that under organic production, the higher net returns observed on organic farming enterprises are due mainly to the lower cost of production. This conclusion is not supported in this study, which shows that the total cost of production on a per cow and a per cwt basis is about 10% higher for organic producers than for conventional producers in the regions from which the survey sample was drawn, and 20% higher when compared statewide. While the differences are not strongly statistically significant, they appear to be due to higher feed costs, higher average labor costs, significantly higher herd replacement costs, and significant transition costs.

All of the higher costs associated with organic milk production appear to be due to the mandatory rules that control organic milk production. It is only by serendipity that feed costs, which constitute about half of the total cost of production, are not as high as they might be under different circumstances. The availability of adequate supplies of relatively low-cost pasture on the organic enterprises in this study has the effect of lowering what would otherwise be prohibitively higher feed costs.

Herd replacement costs, although significantly higher for organic producers than for conventional producers, are also mitigated to some extent by the fact that organic cows are not taxed as hard to achieve maximum production as with conventional dairying. They therefore remain in the herd for longer, which in turn reduces the need to cull and replace animals.

Other mandatory items that increase the costs of organic dairying, such as certification and licensing, small market transportation costs, and the opportunity costs associated with not being able to use conventional medicines on sick or ailing cows, are a relatively small part of the total costs. However, they do contribute to the overall increased costs of organic dairying.

Finally, transition costs are mandatory, and are significant, although for most producers, the amortized loan amounts to only 2–3% of total costs. While the cost of transition is significant, it is difficult to quantify in a more meaningful way.

Although the higher costs associated with organic as compared with conventional milk production do not appear to be strongly significant, the prices paid for organic milk are probably an indication of the real costs associated with converting to organic milk production. When all costs and risks are taken into account, the prices do not appear to be excessive, and without them, there would be no incentive to supply organic milk to the market.

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The effects of outdoor farrowing hut type on prewean piglet mortality in Iowa

M.S. Honeyman and W.B. Roush

Abstract. *Outdoor pig production, usually gestation, farrowing and lactation, is an alternative swine production system that i increasing in popularity. The outdoor farrowing hut is the principal modifier of the environment for the sow and litter, as well a the primary structure to reduce prewean mortality. Prewean mortality of piglets is a major problem for both indoor and outdoo swine herds. Five types of floorless individual farrowing huts were evaluated over 4 years, during the month of September i Iowa. A total of 206 litters by primiparous crossbred sows were farrowed. Piglet deaths for the first 14 days after farrowing wer recorded. Hut type had an effect on piglet prewean mortality ($P < 0.10$). The arc-style hut and the blunt-top A hut had only abou one-third as many litters with piglet mortalities and a lower prewean mortality percentage (3.8 versus 8.5%) than an inverted U hut. This difference would be approximately a half pig/litter increase in litter size at weaning. The superior huts each had a dis tinct and ample sow area and safe pig areas. The safe pig areas were made by a sloping or curved roofline that came to th ground (the arc-style hut) or with guard rails (the blunt-top A hut). Overall prewean mortality for the study was low (6.0%) Crushing of piglets accounted for 93% of the prewean mortality. The study shows that outdoor farrowing systems can achiev competitiveness with low piglet mortality particularly if superior huts are used. Selection of the outdoor farrowing hut is a critica decision in planning outdoor swine farrowing systems.*

Key words: outdoor farrowing, pigs, prewean mortality, swine housing, swine production

Introduction

Outdoor pig production is an alternative swine (*Sus scrofa*) production system that consists of rearing pigs in groups on pastures or paddocks using portable shelters. In an effort to reduce labor needs and control the pigs' environment, traditional outdoor pig production has largely been replaced by intensive indoor confinement systems. When coupled with intensive management, e.g., records and controlled breeding, and new technologies, e.g., all-terrain vehicles and electric fence, modern outdoor pig production has had a marked resurgence in some areas, particularly Great Britain (Edwards, 1994; Honeyman et al., 2001; Thornton, 1988). The move to outdoor pig production has been encouraged by lower capital and building costs, animal welfare concerns, tighter environmental regulations and sustainable agriculture interests (Honeyman, 1996; Thornton, 1988).

Prewean piglet mortality is a major problem in the swine industry. Preweaning mortality of 10–15% is common in the United States. About 50% of the losses occur in the first 3 days after birth. Pig crushing (trauma) by the sow accounts for about 40% of prewean mortalities and is the leading cause of piglet mortality in both indoor and outdoor farrowing systems (Tubbs et al., 1993; Vaillancourt and Tubbs, 1992). In Great Britain pigs weaned per sow per year and piglet mortality has been reported to be comparable to that of indoor herds (Bowman and Ott, 1993). Outdoor pig production in Great Britain has achieved success because of an optimum climate and well-drained soils. The British have also developed intensively managed outdoor systems staffed by individuals with superior swine husbandry skills (Thornton, 1988). However, in the United States, and also Europe, there are reports of higher piglet mortalities for outdoor herds compared to indoor herds (Edwards et al., 1994; Mortensen et al., 1994; Penner et al., 1996).

In outdoor farrowing, the hut is the principal modifier of the environment for the sow and litter. The hut is also the primary structure to reduce prewean mortality due to crushing. With bedding, the hut creates the critical environment for the newborn piglets. One factor affecting piglet mortality in outdoor systems is the type (size and shape) of the farrowing hut (Algers, 1994; McGlone and Hicks, 2000). The objective of this study was to evaluate the prewean mortality of pigs born outdoors in five farrowing hut designs over 4 years.

Materials and Methods

For 4 years (1995–1998), five different floorless farrowing huts were evaluated with an outdoor farrowing herd at the Iowa State University Western Research Farm, near Castana, IA in Monona County (42°N latitude). The huts (ten huts/paddock) were randomly arranged about 9 m apart in alfalfa (*Medicago sativa* L.) paddocks (30.5 m × 91.4 m each). In each paddock one self-feeder and one waterer were positioned at an equa

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distance from the huts. A complete corn–soybean (*Zea mays* L.-*Glycine max* L.) meal lactation diet with 13% crude protein was fed. During September, a total of 206 litters were farrowed in the huts by crossbred primiparous sows (Yorkshire × Duroc × Hampshire). For the month of September at this location, the 40-year long-term mean temperature, mean low temperature, mean high temperature and average rainfall are 17.4°C, 11.2°C, 23.7°C and 83.3 mm, respectively. The sows had all been reared outdoors as part of the outdoor swine herd at the research farm. The sows had free access to feed and water (*ad libitum*) during lactation and were not confined to huts. All huts were floorless, had no insulation, had ventilation openings, and were equipped with a bedding board or equivalent across the doorway to keep bedding and young piglets in the hut. Five outdoor farrowing huts were used in the study, including a wooden modified A-frame hut (1.83 m × 2.13 m, or 3.90 m^2), a steel inverted U-shaped hut (1.42 m × 2.21 m, or 3.14 m^2), a steel arc-style hut (1.68 m × 2.74 m, or 4.60 m^2), a blunt-top A-frame hut (1.68 m × 2.36 m, or 3.96 m^2), and a plastic igloo-style hut (1.52 m × 1.98 m, or 3.01 m^2). Additional hut attributes, including floor space available to the sows and pigs, are shown in Table 1. The floor space of each hut was divided between a sow area, and a pig area not accessible to the sow. The sow area in the hut was defined as the area with at least 46 cm of vertical clearance (from the ground to the hut roof), or the area within the guardrails, if present. The maximum height of the hut sloping roof that would keep the sow from accessing the edges of the hut area, and thus prevent the sow from lying on pigs, was estimated to be 46 cm.

The modified A-frame hut was made from plans provided by the Osco Lumber Co., Osco, Illinois. The inverted U-shaped and the arc-style hut were made by Port-A-Hut, Inc., Storm Lake, Iowa. The blunt-top A-frame hut was made by Sievers' Pig-Saver, Meppen, Illinois. The igloo-style hut was a Hogtel model made by Hampel Corp., Germantown, Wisconsin.

All huts were made available for each of the 4 years. However, no litters were farrowed in the igloo-style hut during one of the years (1997). Otherwise, litters were born in each of the hut types every year. Each paddock contained a mixture of huts.

The huts were bedded with a combination of oat (*Avena sativa* L.) straw and recycled newsprint. Sows were allowed to select their own hut for farrowing but were not allowed to share a hut with another sow during farrowing or initial lactation. For the first 14 days after farrowing, the pigs and bedding were kept in their hut using a bedding board or equivalent. Pigs born alive and subsequent piglet deaths were recorded for each litter for 14 days. Cause of death was recorded as crushing or other, by visual inspection. Piglets were classified as crushed when the body was bruised, injured by being stepped on, or flattened by the sow.

'Preweaning' is generally defined as the period before weaning, usually 3–4 weeks of age. However, in this study, mortality was recorded for only the first 2 weeks of age, because after that period the sows and piglets moved from hut to hut, commingled and group lactated. Therefore, piglet mortalities after 2 weeks of age were not only difficult to record by litter, but also would have been irrelevant to the study because hut type could not be linked to a particular litter. Nursing piglet mortality after 2 weeks of age is minimal; thus, for the purposes of this paper the term 'preweaning' is used synonymously with the 2-week period after farrowing, even though in this study, lactation continued for two additional weeks.

The data were analyzed as a complete randomized design. All sows were first parity, therefore parity was not included in the model. Seasonal effects were not considered, because all litters were farrowed in September. Individual litter data were analyzed using the general linear model procedure (GLM) program of SAS (1996). The model used hut type and year as variables. The experimental unit was a litter. Due to the extensive nature of the project and the high degree of variability inherent in litter size and prewean mortality rates, the significance level was set at the 0.10 level.

Results and Discussion

The primiparous sows farrowed an average of nine live pigs per litter and had an average prewean mortality of 6% (Table 2). The average prewean mortality was lower than that of many herds, whether farrowed indoors or outdoors. The low prewean mortality could be attributed to sows that were accustomed to outdoors, a favorable season (all litters were born in September), high health status, and intensive, experienced management. Also the number of pigs born live was not high (an average of nine per litter) which could favor higher birthweights and lower mortality (Table 2). Crushing accounted for 93% of all piglet deaths. This

Table 1. Characteristics of portable individual outdoor farrowing huts.

Type	Construction material	Piglet guard rails	Safe pig area	Door in corner	Total floor area (m^2)	Sow area[1] (m^2)	Safe pig area[2] (m^2)
Modified A	Wood	No	Yes	Yes	3.90	3.34	0.56
Inverted U	Steel	No	No	No	3.14	2.94	0.20[3]
Arc-style	Steel	No	Yes	Yes	4.60	3.83	0.77
Blunt-top A	Wood	Yes	Yes	No	3.96	1.39	2.57
Igloo-style	Plastic	No	Yes	No	3.01	1.53	1.48

[1] The sow area was defined as the area inside the hut that had at least 46 cm of clearance, or the area within the guardrails, if present.
[2] The safe pig area was defined as total floor area less sow area.
[3] The safe pig area, as defined, was zero for this hut; however, 0.2 m^2 was allocated for the space in the corners as safe pig area because the sow could not fully access the corners.

Table 2. Years tested, litters farrowed, litters with piglet mortalities, live pigs per litter, piglet crushing and total prewean mortality fo five outdoor farrowing huts.

Type	Years	Total litters	Litters with deaths	Litters with deaths (%)	Live pigs born per litter	Pigs crushed[1,2] (%)	SEM[4]	Total prewean mortality[1,2,3] (%)	SEM
Modified A	4	74	25	33.8	9.3	6.4b	1.1	6.7ab	1.2
Inverted U	4	43	20	46.5	8.7	8.1b	1.5	8.5b	1.6
Arc-style	4	49	11	22.4	9.3	3.8a	1.3	3.8a	1.4
Blunt-top A	4	21	2	9.5	8.9	2.4a	2.0	3.7a	2.2
Igloo-style	3	19	6	31.6	8.2	4.7ab	2.2	4.7ab	2.3
Total		206	64						
Average				31.0	9.0	5.6		6.0	

[1] Least square means are reported in the column.
[2] Values in the same column with different letters differ ($P < 0.10$).
[3] Total prewean mortality includes pigs crushed plus all other prewean piglet mortalities.
[4] Standard error of the mean.

percentage was higher than normal because no disease was noted, farrowing was conducted during a favorable season of the year, and all sows were primiparous.

Overall, 31% of the litters had prewean mortality (Table 2). The blunt-top A-frame (9.5%) and the arc-style (22.4%) huts had a lower percentage of litters with mortalities than the overall average (31%) (Table 2). The inverted U-shaped hut (46.5%) had a higher percentage of litters with mortalities than average. The higher percentage of litters with mortalities in the inverted U-shaped huts may have occurred because that hut has no guardrails and no specific attributes (guardrails or sloping roof) that protected the piglets from the sows, i.e., almost no safe pig area. It was also one of the huts with smaller total floor area.

Overall, hut type had an effect on piglet crushing and total prewean mortality ($P < 0.10$). The individual hut types differed in the percentage of piglets crushed and total prewean mortality. The blunt-top A-frame hut and the arc-style hut had a lower piglet crushing rate than the modified A-frame and the inverted U-shaped huts ($P < 0.10$).

The igloo-style hut was intermediate in crushing rate and total prewean mortality. It was not selected by the sows in 1997, perhaps because it was smaller and its design made it difficult for the sows, even these young, smaller primiparous sows, to turn around inside it.

Total prewean mortality followed similar trends as crushing rate. The litters farrowed in the arc-style and the blunt-top A-frame huts had lower total prewean piglet mortality than the litters farrowed in the inverted U hut ($P < 0.10$) (Table 2).

McGlone and Hicks (2000) evaluated two outdoor huts in the Texas Panhandle. The huts they evaluated were American and English and were analogous to the inverted U and arc-style huts in this study. The prewean mortality was lower in the English (arc-style) huts compared to the American (inverted U) huts in the Texas study, as it was in this study, although the overall piglet mortality rates in Texas were higher (19.7 and 11.2%) than in Iowa (8.5 and 3.8%) for the American (inverted U) huts and the English (arc-style) huts, respectively. However, the Texas study recorded deaths for 28 days until weaning, rather than the 14 days in this study, although the pigs in both studies left the huts freely after 14 days.

The superior huts, i.e., with lower preweaning mortality, had greater area where the pigs were safe from the sow. These safe pig areas were either achieved with guardrails (in the blunt-top A hut) or by the curved shape of the hut (in the arc-style hut). The curved shape may be preferable to guardrails because bedding could build up into the guardrail areas, reducing the space available to the pigs. Also the arc-style hut allowed more area for the sow than the other huts.

Implications

The study demonstrated low prewean mortality in a seasonal intensively managed outdoor farrowing herd in Iowa. The farrowing hut type had an effect on the percentage of pigs crushed and the prewean piglet mortality. Selection of an outdoor farrowing hut should be considered as a critical decision in planning outdoor farrowing systems. Huts with adequate safe pig areas are superior. Outdoor farrowing systems can achieve competitiveness if superior huts such as the arc-style or blunt-top A huts are used.

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Public Concerns, Environmental Standards and Agricultural Trade

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There is currently great concern among the public in general, and consumers in particular, about the quality of the environment in relation to agriculture. Such concerns focus on issues such as pollution from agriculture, the quality of landscapes, animal welfare and food safety. As a result, many countries have developed a range of standards, codes of good practice and other policy measures.

This book reviews these issues and relates them to agricultural trade and competition. Features include chapters on world trade and trade liberalisation as well as individual chapters on the situation in the European Union, USA, Canada, Australia, New Zealand, Japan and developing countries.

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Promotion of sustainably produced foods: Customer response in Minnesota grocery stores

Ramona Robinson, Chery Smith, Helene Murray and Jim Ennis

Abstract. *This study assesses consumer perceptions of sustainably produced foods and evaluates whether a supermarket point-of-purchase intervention could increase shoppers' awareness of a campaign designed to promote purchases of sustainably produced foods. The in-store intervention involved the promotion of sustainably produced apples labeled with the Midwest Food Alliance's (MWFA) seal of approval. Minnesota consumers were surveyed at two eastern metropolitan area intervention stores and one eastern metropolitan area comparison store. The in-store campaign lasted 8 weeks and involved individually labeled apples, point-of-purchase materials, and weekly food demonstrations. Prior to campaign initiation, baseline surveys were administered to consumers in two test stores and one comparison store. Follow-up surveys were mailed to these same consumers upon conclusion of the campaign intervention. Independent samples* t*-tests comparing change from baseline to post intervention indicated that a statistically higher percentage of consumers in the test-market group had heard of the Midwest Food Alliance campaign. Furthermore, a statistically higher percentage of the test-market shoppers reported seeing signs and labels promoting the MWFA, indicating that the promotion had some impact. Baseline data gathered from all consumers indicated that foods produced with sustainable practices were important to consumers; however, food characteristics of freshness, taste, safety and healthfulness were most important. The majority of consumers reported that they would be willing to pay 10–30% more for selected sustainably produced foods. Research results indicated that an 8–week in-store intervention was effective at increasing consumer awareness of the MWFA. However, a more powerful intervention (including a longer promotion period with more labeled foods) may be needed to induce shoppers to increase their purchases of sustainably produced foods promoted by the MWFA.*

Key words: alternative agriculture, consumer attitudes, consumer behavior, food marketing, labeled foods, organic foods, point-of-purchase

Introduction

Over the past decade there has been increasing evidence to suggest that more consumers are recognizing that they can make food choices that can impact the environment, community life and the livelihood of local farmers. The demand for locally, organically and sustainably produced foods appears to be growing (Hartman Group, 1996, 1997; Markle, 1997). Consumers are learning that, through demand, they can motivate farmers to produce foods sustainably. In recent years, the Hartman Group (1996, 1997) conducted national surveys to evaluate consumer perceptions of sustainably produced foods; however, most research evaluating consumer behavior as it relates to food production has focused on organically grown (Byrne et al., 1992; FMI, 1997; Goldman and Clancy, 1991; Jolly, 1991; Misra et al., 1991; Thompson and Kidwell, 1998; Wilkins and Hillers, 1994) and locally grown produce (Brooke et al., 1987, 1988; Lockeretz, 1986; Ross et al., 1999, 200 Wilkins, 1996; Wilkins et al., 2000). The Hartman Group (199 showed that the majority of American consumers were willing t purchase environmentally friendly food products, but desire that these foods were more easily obtainable.

Limited research has been conducted to evaluate th effectiveness of in-store interventions on consumer behavio as they relate to how and where food is produced. Reicks et a (1999) evaluated customer response to shelf labeling of organ foods and found that point-of-purchase signage can be effectiv in promoting organic foods and influencing sales. Similarl Brooker et al. (1988) reported that 68% of Tennessee consume who purchased locally grown tomatoes (*Lycopersicon esculen tum*) did so because of the local label. Ross et al. (200 conducted a work-site intervention to promote local produce an found that offering consumers the opportunity to taste an purchase local produce at their workplace motivated them t purchase local foods outside of the workplace.

Our study was designed to assess consumer perceptions sustainably produced foods and to evaluate the success of an i store campaign aimed at the promotion of sustainably produce apples (*Malus domestica*). The study involved a collaborativ effort between researchers at the University of Minnesota an the Midwest Food Alliance (MWFA). The MWFA provid

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third-party approval of farms that grow food in environmentally and socially responsible ways. The Midwest Food Alliance developed a campaign to promote sustainably produced foods and researchers developed a survey tool that was used to measure changes in campaign awareness and identify changes in consumer attitudes and purchases of sustainably produced foods. Additionally, baseline surveys provided data regarding consumer attitudes about selected food characteristics, willingness to pay for sustainably produced foods, perceptions of sustainable agriculture and sources of information about food.

Methods

Study population

A controlled-comparison experimental design was implemented to evaluate whether a supermarket point-of-purchase intervention could increase shoppers' awareness of a campaign developed to promote and encourage purchases of sustainably produced foods. Minnesota consumers were surveyed at two eastern metropolitan area intervention stores (St. Paul, $n=200$; Woodbury, $n=200$) and one eastern metropolitan area comparison store ($n=150$). The comparison store was chosen because its customers shared similar demographic characteristics with customers who shopped at the intervention stores (see Table 2).

Intervention

The overall campaign promoted MWFA apples through labels, point-of purchase materials, advertising and public relations. The in-store intervention involved the promotion of sustainably produced apples labeled with the MWFA seal of approval. The MWFA campaign logo is depicted in Figure 1. The in-store campaign was implemented during fall 2000 in the two intervention stores and conducted for 8 weeks. The in-store campaign promoted the MWFA-approved apples through labels and point-of-purchase materials. Additionally, each test store conducted an all-day kick-off event and weekly 4-hour food sampling demonstrations, which provided consumers with further exposure to the 'Midwest Food Alliance Approved' seal. At these promotional events, project staff and volunteers shared information about sustainable agriculture and the seal of approval by word of mouth and through informative brochures and recipe cards.

Figure 1. Midwest Food Alliance logo.

Survey procedure

Prior to campaign initiation, baseline surveys were administered to consumers in the two test stores and the comparison store. To obtain a representative sample of shoppers at each store, surveys were distributed and completed on weekdays and weekends during morning, afternoon and evening hours. Consumers were approached upon entry into the grocery store and asked if they would be interested in completing a survey and offered a $10 gift certificate to that store as compensation. Participant refusals were tallied and participation rates were subsequently calculated. The participation rates averaged 63% at the test stores and 62% at the comparison store.

At the end of the in-store campaign, follow-up surveys were mailed to the same consumers who completed baseline surveys prior to campaign initiation. The surveys were mailed out with an introductory cover letter and a postage-paid return envelope. One week later, a reminder postcard was sent to consumers who had not yet returned the survey. Three weeks later one researcher phoned consumers who had not yet returned the survey and sent out replacement surveys to those who had requested them. Upon receipt of the follow-up survey, consumers were sent another $10 gift certificate. Follow-up survey return-rates averaged 74% from test-store shoppers, and 79% from comparison-store shoppers. Approval for the study was obtained from the University of Minnesota's Institutional Review Board for Human Subjects.

Instrument

The survey tool was developed based on: (1) a review of the literature, (2) five focus groups conducted with St. Paul residents designed to identify consumer attitudes about, and knowledge of, sustainable agriculture; and (3) sustainable agriculture criteria as defined by the Midwest Food Alliance (MWFA, 2000). Because the present project involved working with the MWFA to develop a campaign to promote sustainably produced foods, survey questions were based on MWFA's perspective of sustainable farming systems (Table 1). The survey included questions designed to evaluate the baseline characteristics of where consumers get information about food, consumer attitudes about purchasing foods with various characteristics, and consumer willingness to pay for sustainably produced foods. An open-ended question was included to evaluate consumer understanding of the term 'sustainable agriculture'. The survey also included questions designed to evaluate changes in consumer awareness of the MWFA campaign, changes in attitude about sustainably produced foods, and changes in reported purchases of MWFA-labeled foods and sustainably produced foods in general. Several other questions were included in the survey and an in-depth evaluation of psycho-

Table 1. Midwest Food Alliance guiding principles.[1]

- Conserving and protecting water resources
- Enhancing the productivity of the land and soil
- Reducing or eliminating pesticides, and eliminating hormones and sub-therapeutic antibiotics
- Preserving the genetic identity of plant and animal species
- Incorporating quality of life issues into our daily decision-making process
- Providing healthy and humane conditions for our animals
- Taking leading roles in both our local communities and the larger agricultural community
- Conserving wildlife habitat while maintaining productivity and economic viability
- Continually improving farm practices by setting goals, using whole-farm decision-making processes and assessing progress toward goals b monitoring for impacts of our decisions on our farm, our family and our ecosystem
- Producing high quality, good tasting, nutritional food
- Maintaining and enhancing an independent, family farm structure

[1] MWFA (2000).

social relationships among baseline measures (beliefs, attitudes, perceived behavioral control, self-identity, intention and behavior) is presented elsewhere (Robinson and Smith, unpublished data). Follow-up surveys were identical to baseline surveys but included additional questions to evaluate campaign awareness and excluded demographic questions.

Means of scaled variables were developed to evaluate attitudes about, reported purchases of, and willingness to pay for sustainably produced foods. Scaled variables designed to measure attitudes (12 questions) and behaviors (7 questions) as they related to sustainably produced foods were based on the criteria defined by the MWFA. For example, with regard to the MWFA principle of maintaining and enhancing the independent family farm structure, an attitude question would be: How important is it that you buy foods produced by farmers who work on farms they own? (seven–item, bipolar unimportant-important scale). With regard to this same principle, an example of a question measuring past behavior would be: In the past two weeks, how many foods produced to support the livelihood of local farmers have you purchased? The behavior variable was scored as follows: non-supportive = 0 (0 items purchased, or don't know), minimally supportive = 1 (1–9 items purchased), moderately supportive = 2 (10–19 items purchased) and highly supportive = 3 (20+ items purchased). A scaled measure was also developed to evaluate consumer willingness to pay for nine different food items. Consumers were asked how much more they would pay for various foods if they were produced in a way that maintains or improves natural resources and the environment, community life and the livelihood of local farmers. Response options included the following: 0% = 0, 10% = 1, 20% = 2, 30% = 3, 40% = 4, 50% = 5, >50% = 6. This scaled variable was created to evaluate demographic characteristics associated with consumer willingness to pay for sustainably produced foods.

Validity and reliability

The survey tool was evaluated for validity and reliability. Content validity was determined upon review of the literature and verification of compliance with sustainable agriculture criteria defined by the MWFA. Experts in the fields nutrition, sustainable agriculture, food systems and represe tatives of the MWFA evaluated the survey for face validi and breadth of coverage. The survey was pilot tested f understandability, readability and ease of completion, with convenience sample of 20 adults. Following the first pil test, revisions were made based on participant suggestion Surveys were piloted a second time with a different group 20 adults. The second round of pilot testing involved t examination of stability reliability, utilizing a test–rete method. Participants completed the survey on one occasi and again 2 weeks later. Ary et al. (1990) suggest that reliability level as low as $r = 0.50$ is acceptable if results a used to make decisions about group behavior; therefor $r = 0.5$ was determined to be a satisfactory reliability level f the present study. With few exceptions, scaled variables a individual survey questions evaluating food informati sources, attitudes and willingness to pay indicated acceptable level of reliability ($r \geq 0.5$–0.9). Reliability scor below the acceptable level were found for individual surv questions regarding food information sources of televisio newspaper and poster/billboard; therefore, results reported f these questions should be interpreted with caution.

The internal reliability of the scales developed to evalua attitudes about, reported purchases of and willingness to pay f sustainably produced foods was assessed using Cronbach's alp coefficient, an index of the inter-item homogeneity or intern consistency (Cronbach, 1951). The internal reliability f attitude (12 items, $r = 0.90$), purchasing behavior (7 item $r = 0.90$) and willingness to pay (9 items, $r = 0.97$) were found be in the 'almost perfect' (0.81–1.0) range (Landis and Koc 1977).

Statistical analysis

Survey data were analyzed statistically using the Statistic Package for the Social Sciences (SPSS, 1999). Descripti statistics of demographic characteristics and consumer wi ingness to pay for sustainably produced foods were summarize Mean scores were computed for consumer attitudes about foo

Table 2. Selected demographic characteristics of consumers surveyed at test and comparison stores.

Demographic variable	St. Paul test store ($n = 199$) (%)[1]	Woodbury test store ($n = 198$) (%)	Comparison store ($n = 150$) (%)
Gender			
Male	39	28	37
Female	61	72	63
Age			
18–30	26	21	23
31–40	24	26	26
41–50	27	24	27
51–60	18	19	13
61+	6	11	11
Ethnicity			
Caucasian (white)	93	91	93
Other	7	9	7
Household annual income ($)			
<20,000	14	6	10
20–34,999	14	10	9
35–49,999	20	7	19
50–74,999	20	19	26
75–100,000	15	26	20
>100,000	18	33	17
Educational attainment			
Completed < 12th grade	3	2	4
H.S. diploma/GED	10	19	26
Assoc/Vocational degree	9	17	21
Bachelors degree	46	40	36
Advanced degree	33	22	13
Married/partnered status			
Married/partnered	48	71	73
Single	52	29	27
Children			
No children	68	56	52
1 child	11	14	15
2 children	12	22	20
3+ children	9	8	13

[1] Percent rounded to the nearest whole number reported for consumers within each store for each demographic variable.

and where consumers get their information about food. Scale item means were used to evaluate consumer attitudes, reported purchases and willingness to pay for sustainably produced foods. One-way ANOVA and *t*-tests were conducted to evaluate whether specific demographic characteristics influenced willingness to pay for sustainably produced foods. Paired-samples *t*-tests were performed to evaluate changes from baseline to post intervention at each of the stores. Independent samples *t*-tests were computed to evaluate the differences between test and comparison-store shoppers with regard to change from baseline to post intervention. Chi-square analysis was performed to evaluate the association between intervention and increases in campaign awareness. Upon return of follow-up surveys, it was determined that some of the shoppers surveyed at the comparison store had shopped at one of the test (intervention) stores at least once and therefore may have been exposed to the in-store intervention. In order to evaluate the effectiveness of the in-store intervention, these follow-up surveys were not included when comparison statistics were calculated. A critical level of 0.05 was used to determine significance of all statistical tests.

In-store monitoring

Weekly 'walk-throughs' by project staff were designed to monitor in-store compliance with intervention protocol. The project staff checked for produce (apples) availability and appropriate display of produce labels and point-of-purchase materials. Project staff also tracked the number of customers to sample the food product as well as the number of brochures and recipes given away while attending the promotional kick-off events and weekly food demonstrations.

Results

Selected baseline results

Survey data were collected from consumers at baseline ($n = 547$) and after intervention ($n = 411$). Baseline results are reported on the study population as a whole. Results from baseline surveys provided information about consumer demographics, attitudes about foods, perceptions of the term 'sustainable agriculture', willingness to pay for sustainably produced foods and data regarding where consumers get information about food. Selected demographic characteristics of consumers at each store are presented in Table 2. Ninety-two percent of the total study population was Caucasian, 65% wer female, and participants ranged in age from 18 to over 60. Th majority had completed some college and earned household salaries of over $50,000 annually. At baseline, there were n statistical differences between intervention and compariso groups in gender, age, ethnicity or household annual income There were also no significant differences in attitudes abou sustainably produced foods, past purchases of sustainabl produced foods or awareness of the Midwest Food Alliance The intervention group was more likely to report being single having fewer children and completing a higher educational level with a higher proportion having completed a bachelors o advanced degree (71% versus 49%).

Table 3. How important is it that you buy foods with the following characteristics? ($n = 547$).

Attitude[1,2]	Mean ± SD[3]
Fresh	5.36 ± 1.38
Good tasting	5.28 ± 1.34
Safe	5.02 ± 1.74
Healthy	4.49 ± 1.88
Produced with practices to protect water quality	3.96 ± 2.31
Produced with practices designed to maintain/ improve natural resources and the environment	3.62 ± 2.44
Produced with practices to protect soil quality	3.52 ± 2.45
Produced by farmers who earn a livable income by farming	3.47 ± 2.68
Low priced	3.30 ± 2.84
Produced on farms that preserve rural communities	3.11 ± 2.78
Labeled as to how and where they were produced	3.02 ± 3.73
Produced with consideration for animal welfare	2.86 ± 2.94
Produced with reduced/no synthetic chemicals or pesticides	2.84 ± 3.05
Uniform and unblemished	2.62 ± 2.75
Produced by farmers who work on farms they own	2.56 ± 2.87
Produced with reduced/no antibiotics or hormones in livestock	2.29 ± 3.08
Produced locally (within the Midwest)	1.96 ± 3.08
Produced organically	1.75 ± 3.21
Produced with genetic engineering	–0.96 ± 3.29

[1] Attitudes expressed on attitude scale as mean ± standard deviation.
[2] Attitude scale range: –6 = extremely unimportant, 0 = neutral, 6 = extremely important.
[3] SD = Standard deviation.

Baseline attitudes were evaluated by asking all consumers t rate the level of importance of purchasing foods with variou characteristics. Food characteristics most important to consu mers included freshness, taste, safety and healthfulness (Table 3) Characteristics associated with sustainable production practice reflected lower mean scores; however, these characteristic remained in the important range.

At baseline, 62% of consumers reported having thought abou how and where their food was produced and 67% reporte wanting to learn more about how and where food is produced Consumers were offered an opportunity to describe in their ow words what sustainable agriculture meant to them. More tha 30% of the participants could not verbalize a definition. A representative sampling of the most common responses fron consumers suggests that they associate the term 'sustainabl agriculture' with foods produced with environmentally friendl practices; produced with reduced chemicals; produced to suppor farmers; produced in a healthy and safe manner; and produce with consideration for the planet and future generation (Table 4).

At baseline, consumers reported getting most of thei information about food from newspapers and magazines, withi the grocery store, and from friends and family (Table 5) Additionally, the majority of consumers were willing to pay 10- 30% more for their food products (Table 6). Depending on th food product, 9–27% of consumers reported that they would no pay a price premium while 12–21% of consumers reported tha they would pay 40% or more for selected food items Educational level was found to influence willingness to pay Consumers with an associates (2–year degree) or vocationa degree were willing to pay more for sustainably produced food

Table 4. Examples of consumers' descriptions of sustainable agriculture.

- Using the least amount of chemicals to get the most amount of product from the land to make a decent living
- Agriculture that is healthy and free of pesticides
- Growing food that is healthy for the people who eat it and environmentally friendly for where it is grown
- Agriculture that protects the natural resources and environment but still supports the farmer and improves the quality of community life
- What my grandfather did
- Agriculture used to support the population
- Growing of food in a way that the resources (land and environment) are left in as good shape or better to support continuous production int the future
- Sustain farmers with an adequate income to support their families and sustain the health of consumers

than consumers with a bachelors degree. The demographic variables of gender, age, ethnicity, household annual income, marital status, children and housing status were not found to be associated with willingness to pay for sustainably produced foods.

Effectiveness of intervention

As a group, both the test and comparison shoppers reported a low level of awareness of the MWFA, moderately supportive attitudes about purchasing sustainably produced foods, and a low level of reported past purchases of MWFA-labeled foods or sustainably produced foods in general (Table 7). At baseline and follow-up, there were no statistical differences between test and comparison-store shoppers in their attitudes about sustainably produced foods, past purchases of MWFA-labeled foods, and past purchases of sustainably produced foods in general. Following the intervention, both test and comparison shoppers reported a statistically significant increase in awareness of the MWFA, with a statistically ($P=0.003$) higher proportion of test-store shoppers having heard of the Midwest Food Alliance campaign. Following the intervention, shoppers at the test and comparison stores reported no significant changes in attitude about sustainably produced foods or purchases of MWFA-labeled foods. However, there was a trend ($P=0.06$) toward increased acknowledged purchases of MWFA-labeled foods among the test-store shoppers. A significant decrease in reported past purchases of sustainably produced foods among the test-

Table 5. Where consumers get information about food ($n=547$).

How often[1] do you get information about food from the following places?	Mean ± SD[2]
Newspaper/magazine	2.26 ± 1.17
Grocery store	1.89 ± 1.17
Friends/family	1.67 ± 1.12
Television	0.94 ± 1.13
Doctor/health professional	0.76 ± 0.99
Poster/billboard	0.63 ± 0.88
Radio	0.54 ± 0.90
Internet	0.52 ± 0.88
Teacher/school	0.30 ± 0.70

[1] Time scale range: 0 = none of the time, 4 = all of the time; expressed on time scale as mean ± standard deviation.
[2] SD = standard deviation.

Table 6. Percentage[1] of shoppers willing to pay more for selected foods produced in a way shown to maintain or improve the environment, community life and the livelihood of local farmers ($n=547$).

	Percent increase willing to pay (%)						
Selected food items	0	10	20	30	40	50	>50
Fruits and vegetables	9	32	27	16	6	4	7
Breads and grains	13	34	24	13	5	4	6
Beans and legumes	20	36	19	12	4	3	5
Milk and cheese	13	29	23	16	6	6	7
Eggs	14	31	22	14	7	5	8
Pork	20	30	22	13	5	4	7
Beef	16	32	21	14	5	6	7
Chicken and turkey	14	28	22	16	7	6	8
Luncheon meats	27	28	19	10	5	4	6

[1] Percentage rounded to the nearest whole number.

Table 7. Evaluation of differences between test and comparison group.

Variable	Test group ($n=292$); mean ± SD[1]	Comparison group ($n=69$); mean ± SD
Awareness of the MWFA [2]		
pre	0.12 ± 0.33 [a]	0.11 ± 0.31 [a]
post	0.42 ± 0.49 [b]	0.21 ± 0.41 [c]
Attitudes supportive of sustainably produced foods [3]		
pre	2.87 ± 1.80	2.66 ± 2.08
post	2.84 ± 1.67	2.54 ± 2.10
Purchases of MWFA foods within the past 2 weeks [4]		
pre	0.11 ± 0.42	0.19 ± 0.43
post	0.16 ± 0.45	0.13 ± 0.38
Purchases of sustainably produced foods within the past 2 weeks [4]		
pre	0.57 ± 0.64 [d]	0.43 ± 0.55 [d]
post	0.44 ± 0.52 [e]	0.33 ± 0.41 [de]

[1] SD = standard deviation.
[2] Awareness scale (Have you heard of the Midwest Food Alliance?): 1 = yes, 0 = no.
[3] Attitude scale range (–6 to +6): –6 = extremely unimportant, +6 = extremely important.
[4] Past purchases scale range (0–3): 0 = non-supportive (0 items purchased or don't know), 1 = minimally supportive (1–9 items purchased), 2 = moderately supportive (10–19 items purchased), 3 = highly supportive (20+ items purchased).
[a,b,c,d,e] Different letters denote statistically significant differences ($P<0.05$) for each variable, both within and between subjects.

store shoppers was found upon completion of the intervention, while there were no changes found in the comparison-store shoppers.

Specific questions included in the follow-up survey assessed whether consumers had seen or heard of the 'Midwest Food Alliance' seal of approval during the intervention. Shoppers at the test stores were compared to shoppers at the comparison store for these analyses. Twenty-six percent of the test-store shoppers reported seeing signs in the test grocery store. Twenty-three percent of the test-store shoppers reported seeing labels on products at the test grocery store. Some comparison-store shoppers falsely reported seeing signs or labels at the comparison store where there was no intervention; however, significantly ($P < 0.0001$) more test-store shoppers reported seeing MWFA signs or labels. Similarly, significantly ($P = 0.006$) more test-store consumers reported tasting MWFA apples at a food demonstration.

Consumers were also asked if they had purchased apples labeled as 'Midwest Food Alliance Approved' within the past 2 months (campaign intervention). Eleven percent of the test-store shoppers reported purchasing these apples. However, 6% of comparison-store shoppers falsely reported purchasing these apples because they were only available in the test stores. There was not a statistical difference between the test-store shoppers and comparison-store shoppers with regard to reported purchases of MWFA apples.

In addition to in-store promotions, the Midwest Food Alliance was marketed by way of outside media sources. During the time of the in-store intervention, two local newspapers and three morning news shows featured the MWFA. Less than 5% of the shoppers reported exposure to newspaper or television promotions of the MWFA and there were no statistical differences between test and comparison groups.

In-store monitoring and consumer exposure

Test stores were monitored throughout the promotion to evaluate compliance with intervention protocol. The kick-off events and six scheduled demonstrations were successfully completed at each test store. As a measure of consumer exposure to the MWFA campaign within the grocery store, the number of promotional materials given away and the number of consumers sampling the food products and were documented. Customers sampled MWFA-approved apples at the kick-off events at each store (St. Paul, $n = 320$; Woodbury, $n = 880$) and at six weekly food demonstrations (St. Paul, $n = 1226$; Woodbury, $n = 1818$). Throughout the intervention, brochures (St. Paul, $n = 200$; Woodbury, $n = 132$) and promotional recipe cards (St. Paul, $n = 158$; Woodbury, $n = 85$) were distributed. MWFA-approved apples were in stock every week of the promotion at each store. Apples were individually labeled each week of the promotion with the exception of the first week, because some had arrived in a previous shipment. The St. Paul store posted point-of-purchase materials intermittently throughout the intervention. The shelf-talkers (a pictorial and written description of the MWFA) were posted only during weeks 1, 2 and 8. The seal-talkers (a larger picture of the MWFA seal of approval placed near the display) were posted for all weeks with the exception of week 3. Th Woodbury store never posted shelf-talkers or seal-talkers due t the nature of their display set-up; however, they positioned large poster near the apple display and did participate in all othe promotional activities.

Discussion

The present research study showed that characteristic associated with sustainable production practices were moder ately important to consumers, although food characteristics o freshness, taste, safety and healthfulness were most important This is consistent with other research showing that food produced with organic (FMI, 1997) or sustainable (Hartma Group, 1996) production practices are of secondary importanc to consumers. The MWFA pilot promotion program appears t have been successful in increasing awareness of the MWF label and possibly increasing ($P = 0.06$) reported purchases o MWFA-promoted apples among test-store shoppers.

Previous research evaluating in-store campaigns has show that changes in campaign awareness may be seen prior to actua changes in behavior (Kristal et al., 1997; Rodgers et al., 1994) Rodgers et al. (1994) conducted a 2–year intervention promotin high-fiber, low-fat foods and found that consumers increase awareness of the program itself; however, researchers found n statistically significant effect on self-reported purchases of high fiber and low-fat foods and only modest changes in attitudes Similarly, Kristal et al. (1997) conducted an 8–month interven tion promoting fruit and vegetable consumption and found tha consumers increased awareness of the intervention but did no significantly increase their fruit and vegetable consumptio when compared to control-store shoppers. In contrast to these studies, Reicks et al. (1999) found that following an in-stor intervention, consumers at upscale grocery stores increased thei awareness of the organic foods promotion and reporte purchasing significantly more organic products than control store shoppers. It appears that increasing consumer awarenes may be the first level of consumer change, while actua behavioral changes may require sustained promotion wit repeated exposures. Previous research has shown that althoug behavior change may be the ultimate goal, changes in awarenes are likely to precede changes in attitudes and behavior. Russo e al. (1986) have suggested that prior to implementing behaviora changes, it is likely that consumers must first become aware o new information in order to develop greater knowledge an more favorable attitudes.

It is understandable that a limited campaign effort coul increase consumer awareness of the MWFA campaign an possible increased purchases of MWFA-labeled foods, bu would not likely lead to increased purchases of sustainabl produced foods in general. The present study found tha consumer attitudes about sustainably produced foods amon test- and comparison-store shoppers remained in the moderatel supportive range from before to after intervention; however, decrease in purchases of sustainably produced foods among th test-store shoppers was observed. This decrease was likely du to their relatively higher, albeit not significant, degree o

purchases of sustainably produced foods at baseline and because of the change in season from early fall (baseline) to late fall (follow-up). In Minnesota, consumers are likely to perceive that there are fewer foods (particularly fruits and vegetables) produced with sustainable production practices available in the late fall and therefore may be less likely to purchase them. Future research efforts should consider this issue when developing a campaign intervention evaluating changes in food purchases based on sustainable production practices.

Conclusions and Marketing Implications

This study showed that a collaborative effort between marketers of sustainably produced foods and retail management could be carried out successfully. MWFA-approved apples were marketed successfully within the grocery stores; however, additional up-front planning and collaboration with retailers may have improved the outcome of compliance with intervention protocol and maintenance of point-of-purchase displays. It appears that retailers interested in collaborating with marketers of sustainably produced foods must take an active interest in maintaining the point-of-purchase displays in order to realize the greatest increases in sales. Previous research has indicated that retailers are interested in point-of-purchase technology; however, it is essential that retailers consistently maintain the in-store displays if they are to be effective (Shimp, 1997).

Results from the present study should be reviewed in the light of recognized limitations. There were differences between intervention and comparison stores with regard to store type. However, an attempt was made to match the stores as closely as possible, based on consumer demographic characteristics. Although consumers at the intervention and comparison stores were matched for most demographic variables (gender, age, ethnicity, income), they were different only for educational level, marital status and number of children. Follow-up statistical analyses indicated that these demographic variables were not found to be associated with level of awareness of MWFA or reported sightings of MWFA signs and labels. Thus, these demographic variables were not believed to influence outcomes in awareness of the Midwest Food Alliance.

Researchers attempted to track actual sales of MWFA apples but encountered difficulties due to the infrastructure at the retail markets. Retailers coded apples by type and not by grower; therefore, sales of MWFA apples could not be delineated by sales receipts. Future research efforts should consider this issue and identify tracking systems compatible with retailer infrastructure in order to obtain more comprehensive data to assist in the evaluation campaign effectiveness. It is likely that other researchers working in collaboration with local grocers will encounter these problems as well. Finally, the study population included a high proportion of white, upper income, and highly educated consumers. Therefore, results from this research may only be applicable to this segment of the population. Further research with different sample populations may provide additional insight into consumer attitudes, behaviors and effectiveness of an in-store campaign intervention.

In general, consumers had favorable attitudes about characteristics associated with sustainably produced foods. This finding indicates that they may be ready to implement behavior changes. Future marketing efforts might benefit by educating consumers about the importance of sustainably produced foods and making the MWFA label and products highly visible within the store. Additionally, it may be advantageous to promote several food products for a duration of longer than 8 weeks to increase exposure to the MWFA campaign and label. Because consumers reported obtaining most of their information about food from newspapers and magazines, within the grocery store, and from friends and family, future marketing efforts might benefit from utilizing these information sources in promotions.

In terms of setting an appropriate price point for sustainably produced items, further research is warranted. There is a contingent of consumers who say they are willing to pay greater than 40% more for sustainably produced foods; however, the majority of consumers reported that they would pay 10–30% more. It remains unclear as to whether consumers would actually pay these price premiums, although low-priced foods were not a top priority for this population. When pricing sustainably produced food items, these issues should be considered to determine the best profit potential for both the farmers and storeowners.

In this study, an 8-week campaign limited to one food item was sufficient to increase awareness of the MWFA label. MWFA-approved food products will continue to be promoted within Midwest grocery stores and, in time, consumers may begin to implement identifiable behavior changes.

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